Sierra M122
SAS/SATA Protocol Analyzer

User Manual

Sierra M122
SAS/SATA
Sierra M122
Available
Initiator
Trigger
Error
Link
Speed
Frame/OOB
I1 T1
I2 T2
Target
Trigger
In
Out
TELEDYNE LECROY

For software version 5.92

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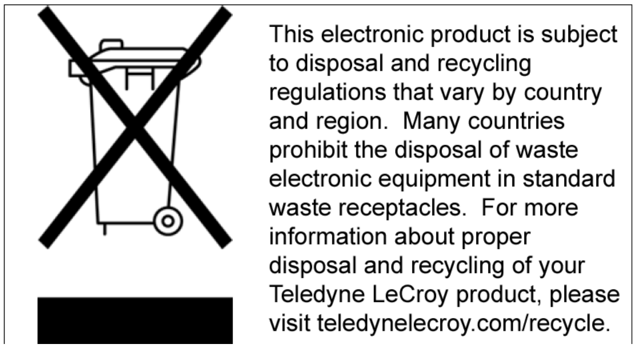

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Chapter 1

Introduction

This manual describes installation and operation of the Teledyne LeCroy Sierra M122™ Protocol Analyzer and includes examples of typical applications.

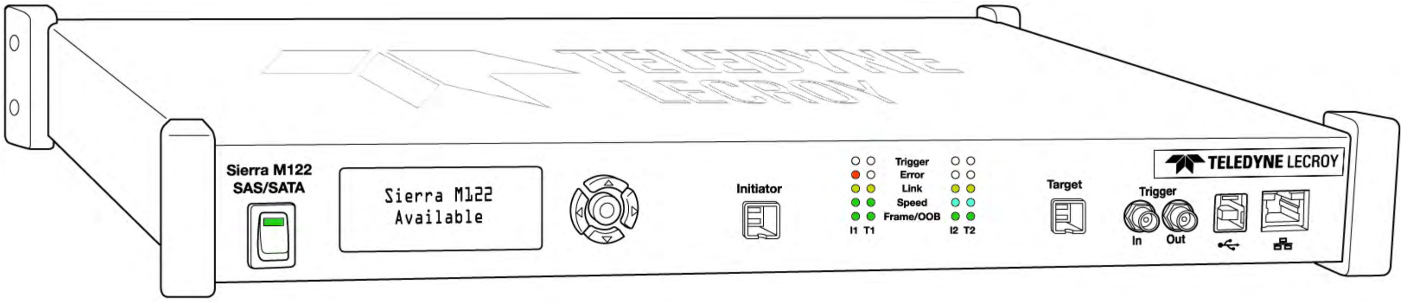


Figure 1.1: Teledyne LeCroy Sierra M122 Protocol Analyzer.

1.1 Analyzer Overview

The Sierra M122 is a SAS/SATA Protocol Analyzer allows the examination of the communication between SAS/SATA devices by displaying and decoding the protocol traffic exchanged by these devices. The Sierra M122 Analyzer is typically used by Hardware, Firmware, Design and Application Engineers during the development of a new product or the verification of an existing product. The Sierra M122 Analyzer allows capturing, triggering and filtering of Serial Attached SCSI or Serial ATA traffic.

The analyzer provides for bi-directional trigger and capture of commands, primitives, patterns and all bus conditions. The analyzer allows to either capture all traffic or selectively include/exclude certain types of traffic and traffic patterns. The start of capturing can be either trigger based on specific conditions or manually by pressing a button.

The Sierra M122 Analyzer has a USB port and an Ethernet port to connect to a computer. You can cascade analyzer units for higher port counts. The analyzer allows you to select frames to include and exclude for capture. Capturing can be triggered based on a specific event or manually.

The Sierra M122 Analyzer provides a full range of views and statistical reports.

1.2 Features

- Up to 12 Gb/s SAS and 6 Gb/s SATA protocol analysis or error injection
- Capture, triggering, and filtering of Serial Attached SCSI or Serial ATA packets
- Easy mode triggering
- Cascade up to 8 analyzers
- Sync with Teledyne LeCroy Sierra family products
- CrossSync
- Hardware filtering by Analyzer at Wire speed
- Automatic error detection
- Comprehensive decoding of SAS and SATA data traffic
- Logical and chronological traffic displays
- Statistical reporting
- Trace memory of up to 32 GB (Sierra M122) or 64 GB (Sierra M124)
- GbE & USB 3.0 host interfaces to connect to a host machine
- CATC API
- Automation API
- Error Injection Functionality (InFusion Jammer)
- Traffic Generation Functionality (Trainer)

1.3 Receiving Your Analyzer

The analyzer package includes the following components:

- 1 Sierra M122 Analyzer identified in the packing list
- 2 miniSAS HD cables, 1 meter
- 1 USB A-B 2.0 cable, 1.8 meter
- 1 USB A-B 3.0 cable, 1 meter
- 1 Ethernet cable, 10 feet
- 1 Three-Prong AC power cord
- 1 Installation DVD-ROM with software and documentation
- 1 Sierra M122 Getting Started manual

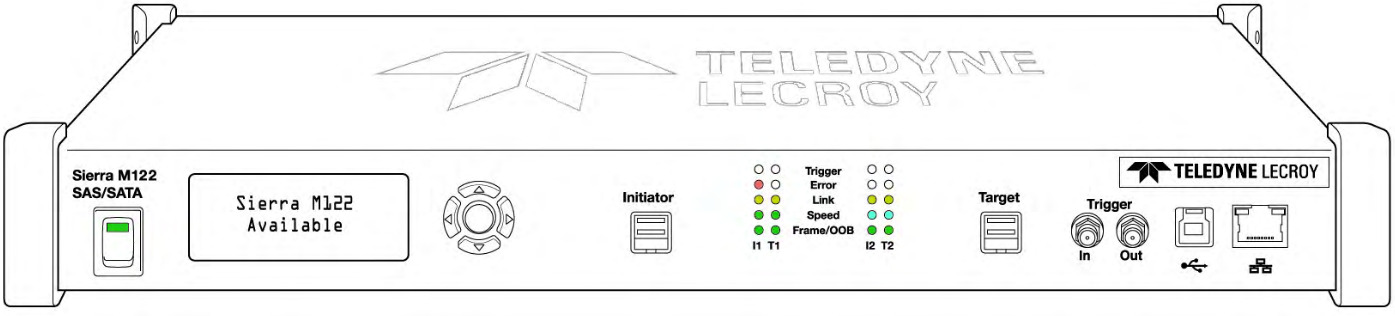
1.4 Unpacking Your Analyzer

Inspect the received shipping container for any damage. Unpack the container and account for each of the system components listed on the accompanying packing list. Visually inspect each component for absence of damage. In the event of damage notify the shipper and Teledyne LeCroy Corporation. Retain all shipping materials for shipper’s inspection.

1.5 Analyzer Front Panel

The Analyzer has the following features:

- Power Switch
- Frame, Speed, Link, Error, and Trigger LEDs
- External Trigger Input and Output
- Initiator and Target mini-SAS connectors (4)
- Expansion In/Out data ports and Clock In/Out connectors
- Status and Configuration LDVD Display
- USB port for host connectivity
- Gigabit Ethernet port for network connectivity
- Power In (on back)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Sierra M122
Available
Initiator
Trigger
Error
Link
Speed
Frame/OOB
I1 T1
I2 T2
Target
TELEDYNE LECROY
Trigger
In
Out

Figure 1.2: Front Panel.

1.6 LEDs

Each link is supported by LEDs with the following functionality:

GreenThis LED is illuminated during the OOB (Out of Bound) sequence before the link is established and after link is established it indicates traffic on the bus.

Orange This LED is illuminated as follows:

Speed	Initiator	Target
1.5G	On	On (Green)
3.0G	On	On (Green)
6.0G	On	On (Yellow)
12.0G	On	On (Blue)

Yellow This LED is illuminated when a link is established.

Red This LED illuminates when an error occurs.

Blue This LED is illuminated when a trigger occurs.

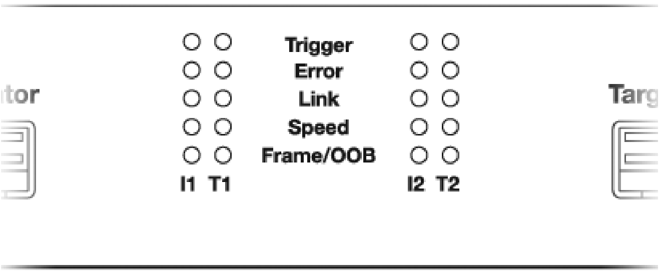


Figure 1.3: LEDs.

1.6.1 Status and Configuration Display

The Analyzer front LCD display indicates the configuration and status of operations. For example, during initialization, the LCD panel displays boot status messages.

1.6.2 Temperature and Humidity

The hardware should operate flawlessly in the following temperature ranges:

- ☐ Operating: 0 °C to 50 °C (32 °F to 122 °F)
- ☐ Non-Operating: -20 °C to 80 °C (-4 °F to 176 °F)

The hardware should operate in the following humidity range:

- ☐ 10% to 90% RH (non-condensing)

1.7 Installing Your Analyzer

1.8 Software Installation

The SAS and SATA software works on systems using the Windows® XP, Windows 7 (x86, x64) Windows 8 (x86, x64), Windows Server 2003, Windows Server 2008 and Windows Server 2012 R2 operating systems. 64-bit Windows OS is recommended because it allows using more RAM memory. Other Operating Systems limit the RAM to 3GB.

1. Insert the Installation DVD-ROM into the DVD drive on the host machine.
2. The installation automatically starts setup, unless Auto Run is off. In that case, select the DVD ROM from “My Computer” and click **Setup**.
3. After the warning to close all other programs and before starting the installation, the Install component selection opens.
4. Select components for installation.
5. Click **Next** to complete the installation.

1.8.1 System restart

You must restart your computer before you can use your Protocol Suite software.

1.8.2 Error Message

If you get an error message during installation of the drivers for Window, consult your system administrator. Your system may allow only administrator-level users to copy such driver files.

1.9 Hardware Setup

1.9.1 Separate Systems

When using the analyzer, it is recommended to use a system to generate bus traffic and a second system to run the software, to avoid characterization of traffic generated by the analyzer.

1.9.2 Connecting in General

Note: You must install the software before connecting the analyzer to the host machine for the first time.

To set up the analyzer:

1. Plug the power adapter into the unit, and then plug the power adapter into a 100V–240V, 50Hz–60Hz, power outlet. Turn on the Power switch.
   At power on, the analyzer will go through initialization as shown on the LCD display.
2. Connect the USB cable between the Sierra M122 USB port and a USB port on the host machine. The host machine's operating system detects the analyzer and driver files.
3. Connect the analyzer as shown in Figure .

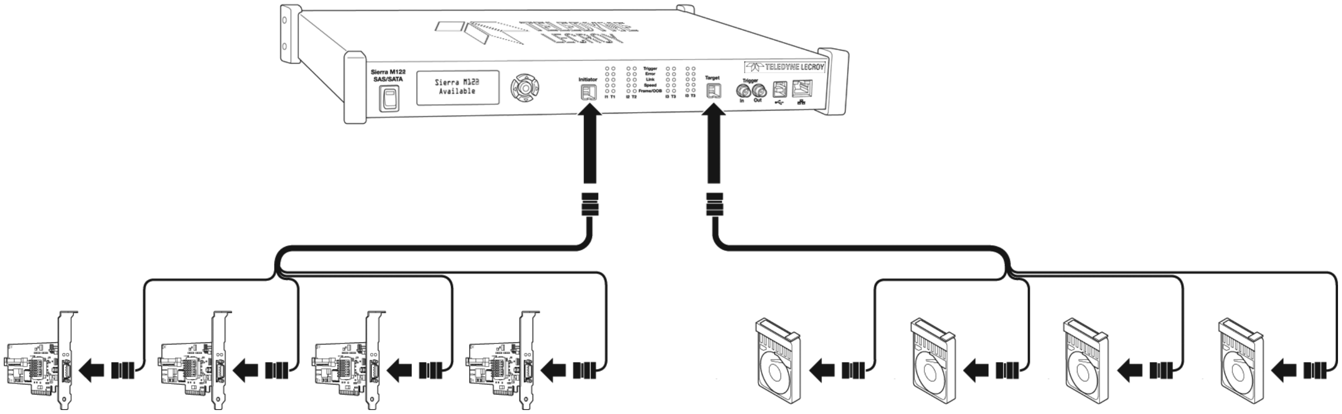

TELEDYNE LECROY
Sierra M122
SAS/SATA
Sierra M122
Available
Initiator
I1 T1
I2 T2
Trigger
Error
Link
Speed
Frame/OOB
I3 T3
I3 T3
Target
TELEDYNE LECROY
Trigger
In
Out

Figure 1.4: Analyzer Single Lane Connections.

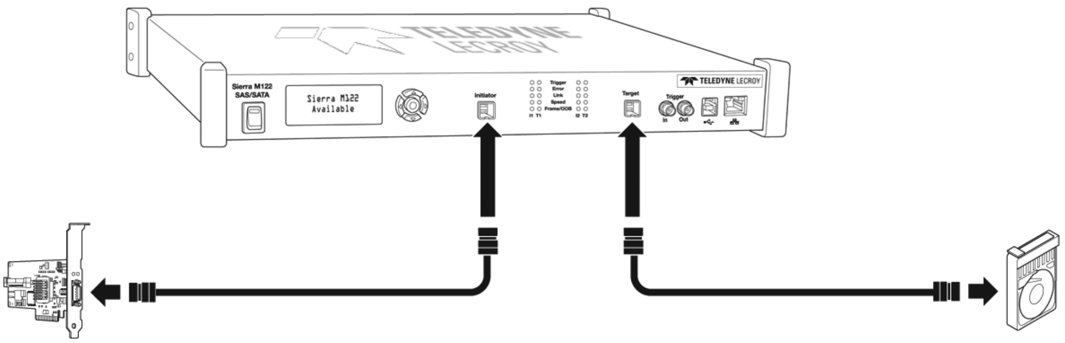


Figure 1.5: Analyzer MiniSAS HD Connections.

1.9.3 Cables to Use

When connecting between a HBA and a disk drive, use a crossover MiniSAS HD from the initiator port on the Sierra to MiniSAS HD, and a MiniSAS HD from the target port to SATAx4, connecting the SATA connector to the disk drive.

1.10 Expandability

The Analyzer provides cascading, external power and other functions through optional expansion cards on the back panel. You can expand by:

- ☐ Cascading with CATC SYNC Expansion Cards
- ☐ Using the Power Expansion Card

You can remove expansion cards with two simple tools.

Cascading and Memory Size
For example, you have two units. The first one has 2 GB memory. The second one has 4 GB memory. The system shows the entire memory as 6 GB. If you set buffer size to 6 GB, the system programs the first board for 2 GB and the second board for 4 GB. You can consider this ratio when you set buffer size to any value. For example, if you set buffer size to 2 GB, the system programs the first board for (2*2)/6 GB and the second board for (2*4)/6 GB. Any unit that has more memory will have larger buffer size.

1.10.1 Cascading with CATC SYNC Expansion

You can use cascading of analyzer units for higher port count, by connecting the units through the optional CATC SYNC Expansion Card on the analyzer back. Using the CATC SYNC Expansion Cards will not sequentially trigger the State Machine in Advanced mode.

Connecting a Sierra M122 and a Summit T3-16 via the CATC Sync Expansion Card

A Sierra M122 and a PCIe Summit T3-16 are connected using their CATC Sync ports which require an optional expansion card (ACC-EXP-002-X).

Note: Refer to the relevant protocol analyzer user manual for instructions on how to install the expansion board.

To do so, perform the following steps:

1. Make sure to stop any recordings in progress.

Note: You may plug/unplug the sync cable while the analyzer unit is powered on.

---

2. Connect the female end of the sync cable to the SYNC OUT port of the Sierra M122.
3. Connect the male end of the sync cable to the SYNC IN port of the PCIe Summit T3-16.

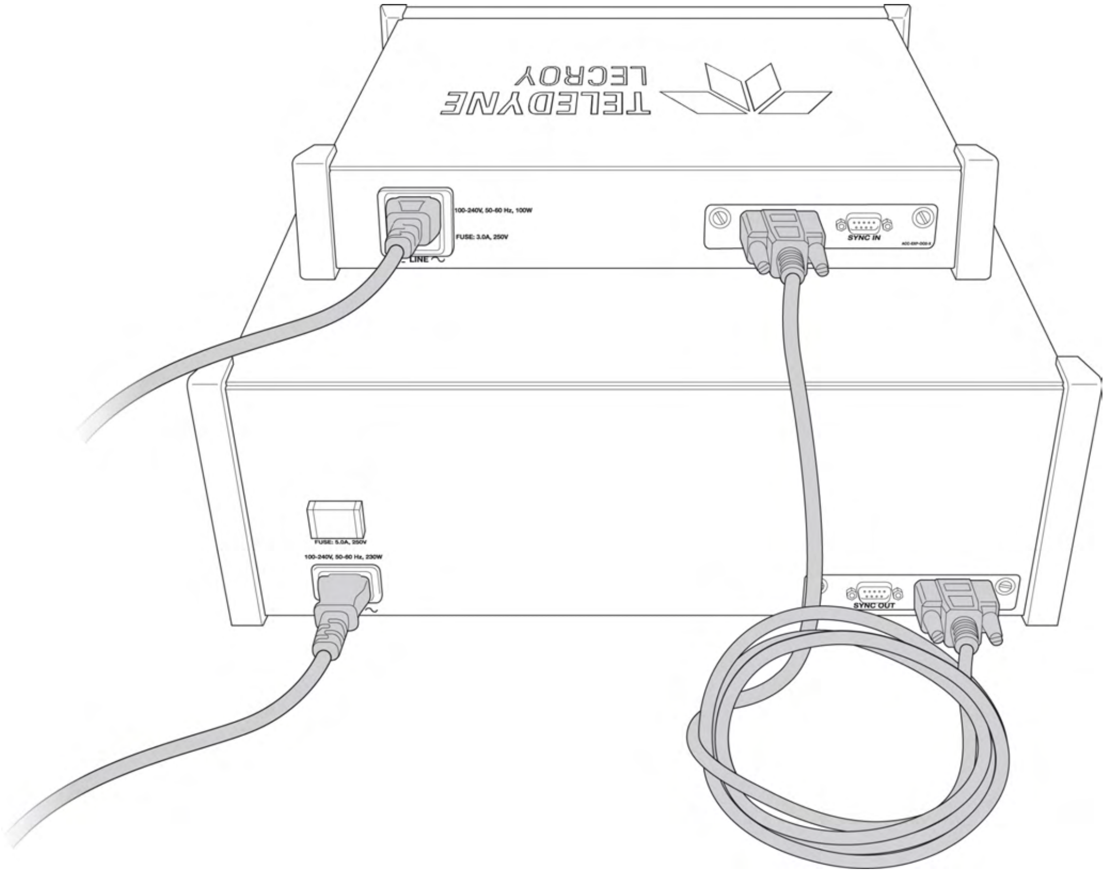

TELEDYNE LECROY
100-240V, 50-60 Hz, 100W
FUSE: 3.0A, 250V
LINE
SYNC IN
FUSE: 5.0A, 250V
100-240V, 50-60 Hz, 230W
SYNC OUT

Figure 1.6: An Example of Connecting a Sierra M122 and a Summit T3-16.

You can cascade up to eight Sierra Analyzers, if they all have a CATC SYNC expansion card.

Note: If the Sierra M 122 has a CATC SYNC Expansion Card, you can cascade with Sierra M6-4, M6-2 and M6-1.

1.10.2 Select Device

After starting the software, click on **Setup a**nd select **All Connected Devices**.

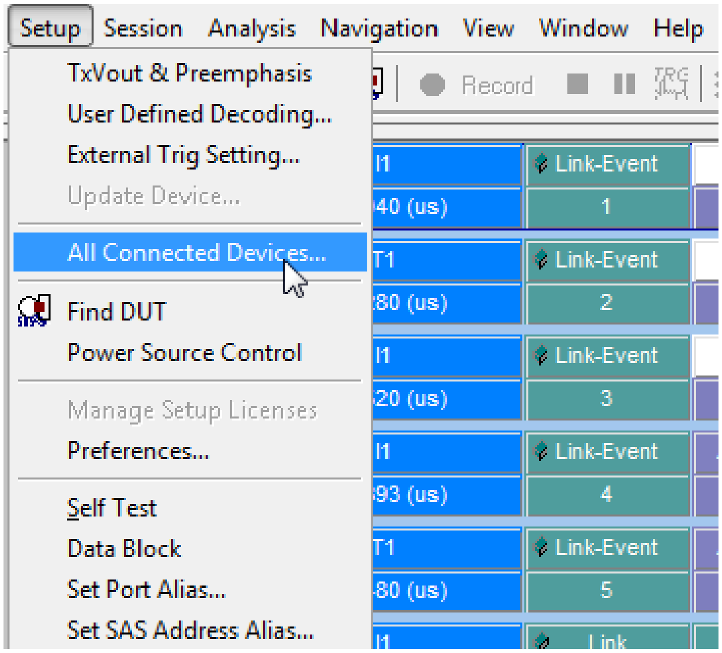

Setup
Session
Analysis
Navigation
View
Window
Help
TxVout & Preemphasis
User Defined Decoding...
External Trig Setting...
Update Device...
All Connected Devices...
Find DUT
Power Source Control
Manage Setup Licenses
Preferences...
Self Test
Data Block
Set Port Alias...
Set SAS Address Alias...
Record
Link-Event
1
2
3
4
5

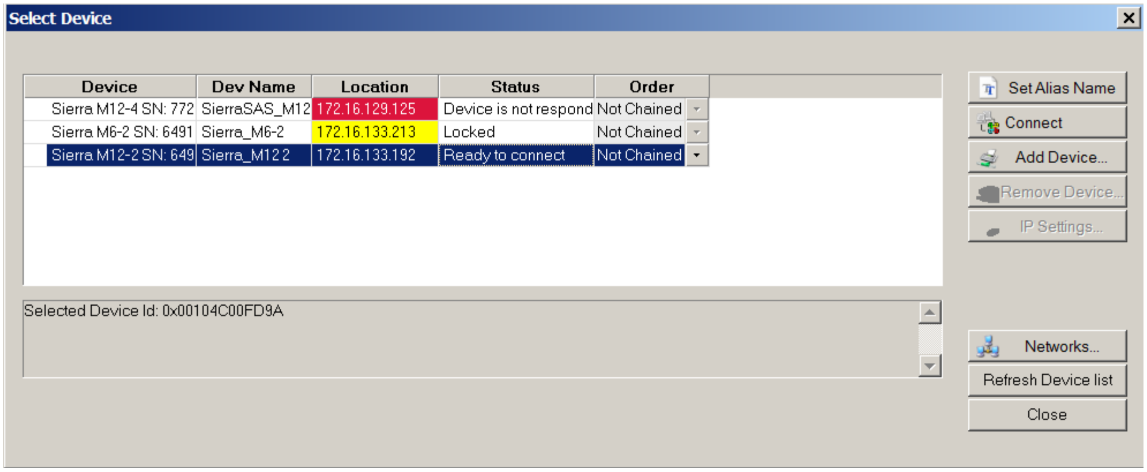
Figure 1.7: Connecting to All SAS/SATA Devices.

The **Select Device** dialog allows connecting and disconnecting analyzers on the fly, without restarting the application.

The new Device List (introduced in version 4.10) mandates using updated firmware in order to detect the analyzer over Ethernet. Thus, the analyzer must be updated over USB before it can be used remotely over Ethernet. This is applicable for any update from version 4.00 or earlier to any version from 4.10 or later.

The following **Select Device** dialog displays (see Figure 1.8 on page 25). The colors in the ‘Location’ column mean the following:

- Red: Firmware and/or BusEngine components need to be updated to the latest version
- Light Blue: The device is ready to be connected.
- Yellow: The device is locked.
- Green: The software is connected and ready to run.


Select Device
Set Alias Name
Connect
Add Device...
Remove Device...
IP Settings...
Networks...
Refresh Device list
Close

Device	Dev Name	Location	Status	Order
Sierra M12-4 SN: 772	SierraSAS_M12	172.16.129.125	Device is not respond	Not Chained
Sierra M6-2 SN: 6491	Sierra_M6-2	172.16.133.213	Locked	Not Chained
Sierra M12-2 SN: 649	Sierra_M122	172.16.133.192	Ready to connect	Not Chained

Selected Device Id: 0x00104C00FD9A

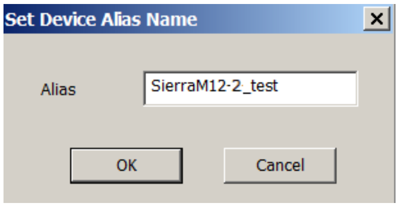
Figure 1.8: Select Device Dialog.

Note: Click **Refresh Device List** to display all the devices on the network.

The Select Device dialog displays the following buttons:

Set Alias Name

Click **Set Alias Name** to display the Set device alias name dialog as shown below.


Set Device Alias Name
OK
Cancel

Alias: SierraM12-2_test

Figure 1.9: Set Device Alias Name Dialog.

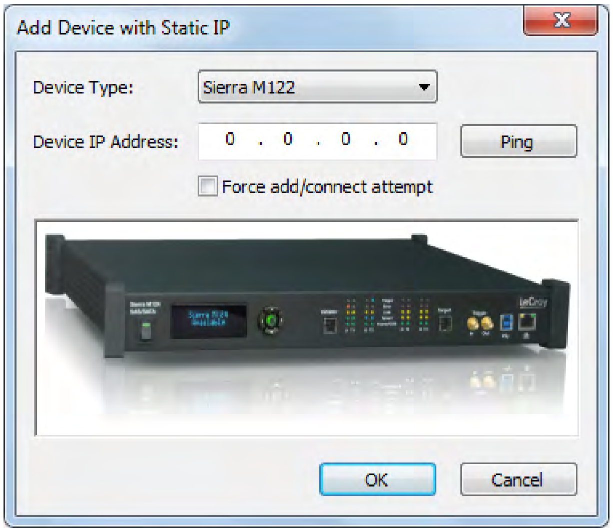
Disconnect

Click **Disconnect** to disconnect a device.

Add Device...

Click **Add Device** to add a device with a static IP address.

Note: You must close and re-open the application when changing to static IP mode through the front panel instead of the application.



Device Type: Sierra M122

Device IP Address: 0 . 0 . 0 . 0

☐ Force add/connect attempt

Figure 1.10: Add Device with Static IP Dialog.

Force Add/Connect Attempt

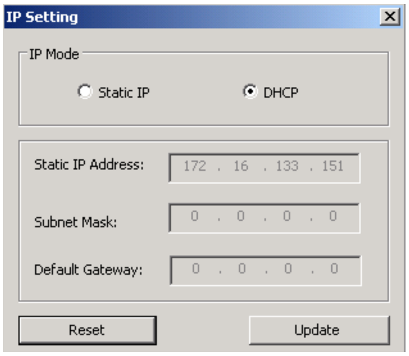
Use this option if the application's Ping function fails (the button in the upper right corner), but you are sure that the address is correct, and you still want to attempt the connection. This setting is stored in the device.

Remove Device

Click **Remove Device** to remove a previously added device.

IP Settings...

Click **IP Setting** to reset IP settings of a device. The following IP Setting dialog displays.



○ Static IP ● DHCP

Static IP Address: 172 . 16 . 133 . 151

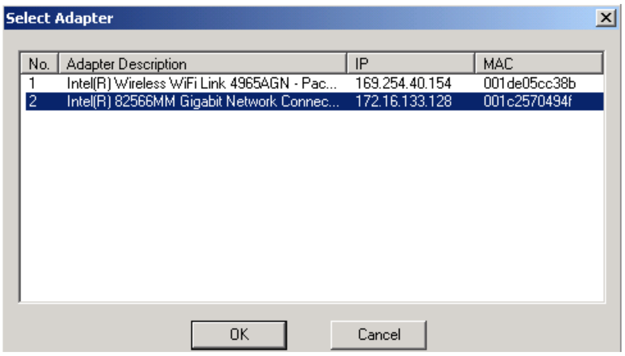
Subnet Mask: 0 . 0 . 0 . 0

Default Gateway: 0 . 0 . 0 . 0

Figure 1.11: IP Setting Dialog.

Networks...

Click **Networks** to select a network adapter. The following dialog displays.


Select Adapter
OK
Cancel

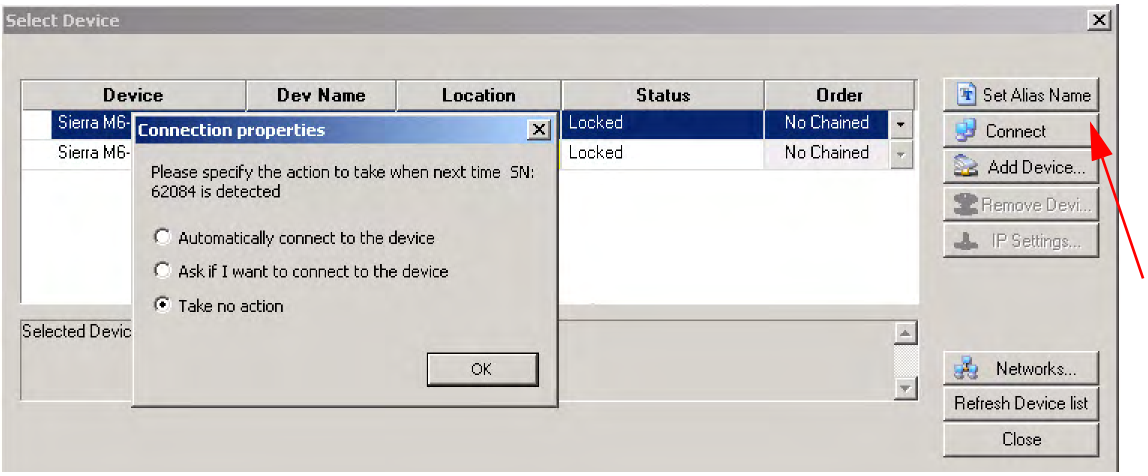
No.	Adapter Description	IP	MAC
1	Intel(R) Wireless WiFi Link 4965AGN - Pac...	169.254.40.154	001de05cc38b
2	Intel(R) 82566MM Gigabit Network Connec...	172.16.133.128	001c2570494f

Figure 1.12: Select Adapter Dialog.

Refresh Device List

Click **Refresh Device List** to refresh the device list.

To connect to a device, select a device which is Ready to Connect and click the **Connect** button on the right. The Connection Properties dialog is displayed (see the following screen capture).


Select Device
Set Alias Name
Connect
Add Device...
Remove Devi...
IP Settings...
Selected Devic
Networks...
Refresh Device list
Close
Connection properties
OK

Device	Dev Name	Location	Status	Order
Sierra M6-			Locked	No Chained
Sierra M6-			Locked	No Chained

Please specify the action to take when next time SN: 62084 is detected

○ Automatically connect to the device
○ Ask if I want to connect to the device
● Take no action

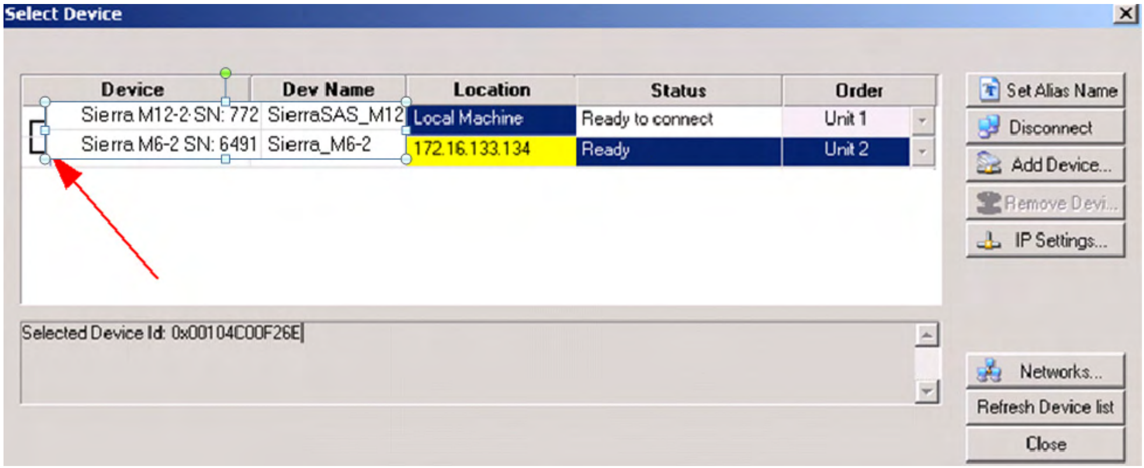
Figure 1.13: Connection Properties Dialog

Specify one of the actions from the following:

- ❑ Automatically connect to the device
- ❑ Ask if I want to connect to the device
- ❑ Take no action

If ‘Automatically connect to the device’ is selected, the next time the application opens the device will be automatically connected.

In the **Select Device** dialog chained or cascaded units are displayed in the **Device** column with a **[** (square bracket) icon. The sequence of the units is displayed in the **Order** column. See the following screen capture.



Device	Dev Name	Location	Status	Order
Sierra M12-2 SN: 772	SierraSAS_M12	Local Machine	Ready to connect	Unit 1
Sierra M6-2 SN: 6491	Sierra_M6-2	172.16.133.134	Ready	Unit 2

Selected Device Id: 0x00104C00F26E

Figure 1.14: Select Device Dialog Displaying Unit 1 and Unit 2 Chained.

VPN Connections

VPN solutions establish special network connections to primary networks and in some cases use special virtual network adapters as part of their solution.

For such VPN solutions sometimes it is necessary to select (in the Select Adapter dialog) a virtual adapter specifically created for a VPN connection in order to successfully discover and connect to devices over a VPN connection.

In most cases, this special virtual adapter will have a special IP address different from the primary network address range and have a Point-to-Point Protocol (PPP) type.

There are also VPN solutions that may require selecting an Ethernet/Wireless adapter that will be used for transferring VPN data.

So after a VPN connection to the primary network is established, please ensure that the correct network adapter suitable for your VPN solution is selected in the Select Adapter dialog.

1.10.3 Using the Power Expansion Card

Two types of Power Expansion Cards are available and the type must be specified when ordering the unit.

- Power Expansion Card (part number: ACC-EXP-004-X)
- Power Expansion Card 2 (part number: ACC-EXP-005-X)

Power Expansion Card (part number: ACC-EXP-004-X)

You can use the Power Expansion Card to power the drives to test for Emulation, SATA Compliance, and SAS Verification. The Power Expansion Card can supply 5 V or 12 V.

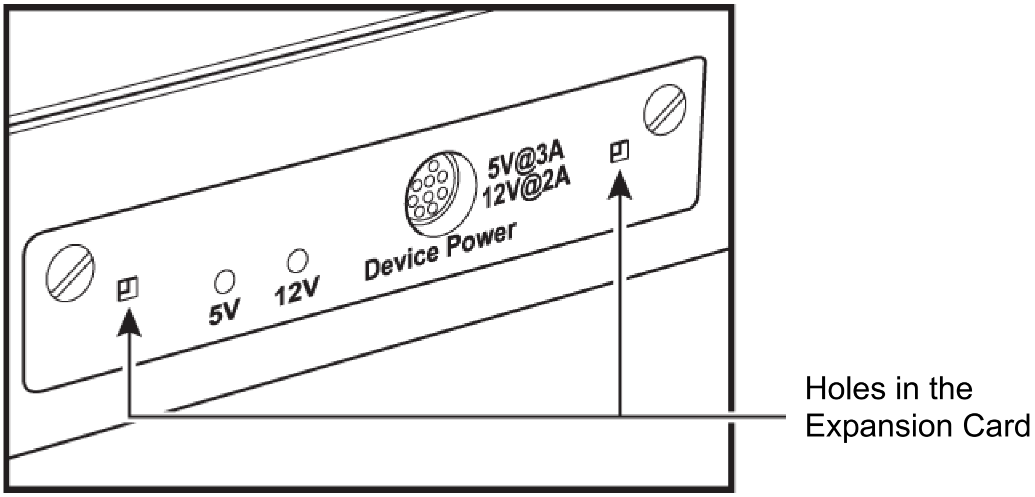


Figure 1.15: Power Expansion Card.

Power Expansion Card 2 (part number: ACC-EXP-005-X)

This card has several capabilities (see Figure 1.16 on page 29):

- Supplies power to devices at 12v, 5v, 3.3v, 1.5v and/or 1.2v.
- Allows monitoring in the trace of the DevSlp signal as generated by the Trainer or Host Emulator, as well as when generated directly from a Host (using a dedicated DevSlp cable). See “DevSlp” on page 402 and “Exit_DevSlp” on page 403). Also see “Device Sleep (DevSlp)” on page 131.
- Allows CATC Sync functionality to enable cascading, so there is no need to toggle between the Power Expansion Card and the Sync Expansion Card.
- Allows power measurement to monitor and record the power, current and voltage being used by the device it powers (will be supported in a future software release).

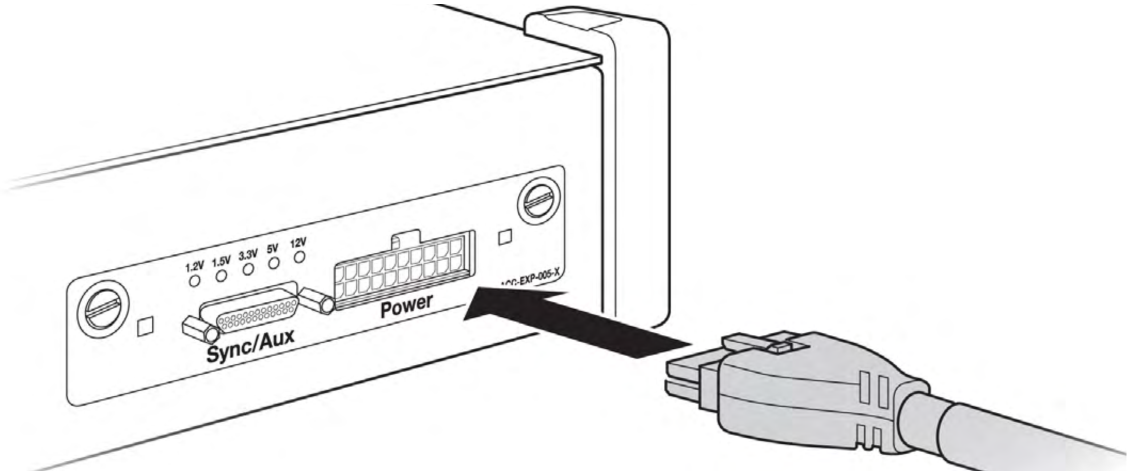


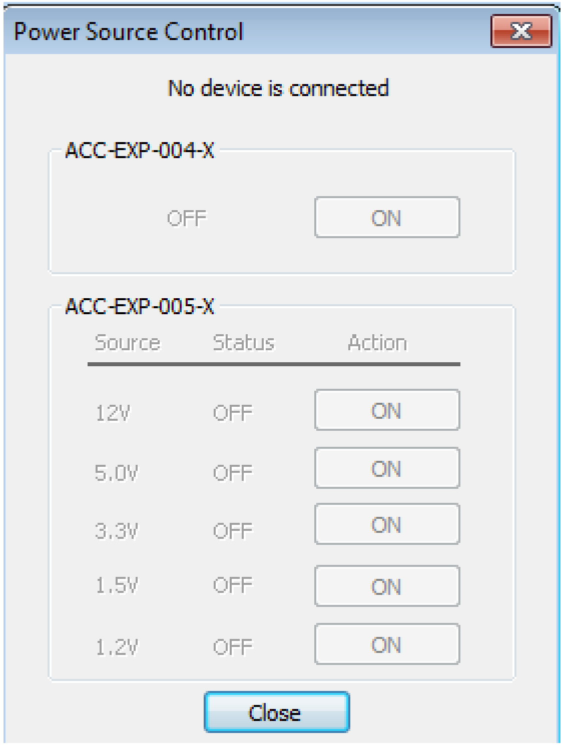
Figure 1.16: Power Expansion Card 2

It is shipped with the following three cables:

- Standard 4-pin power connector (ground, 5v, 12v only): This is a direct replacement for the existing Power Expansion Card cable.
- SATA 15-pin power segment connector: This plugs in to the power segment of the standard SATA connector, allowing to control and monitor its power and DevSlp.
- DevSlp cable: This cable is used to monitor DevSlp levels when the Device is connected directly to the Host. It is up to the user to supply a copy of the DevSlp signal coming from the Host to connect to the DevSlp wire of this cable, as well as to connect the adequate ground wire of this cable.

Activating the Power Expansion Cards

Select **Setup > Power Source Control** to display the Power Source Control dialog (see Figure 1.17 on page 30). Depending on the Power Expansion Card/s ordered the applicable device controls are enabled. Make the appropriate selections and click **Close**.



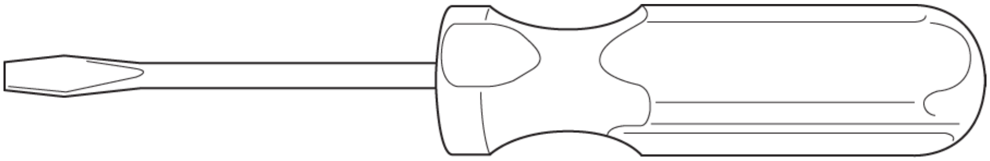
No device is connected

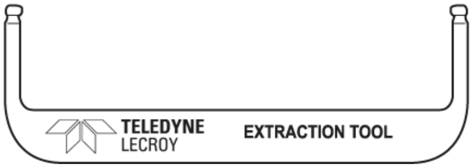
Figure 1.17: Power Source Control Dialog

Removing Expansion Cards

You can remove expansion cards using two tools:

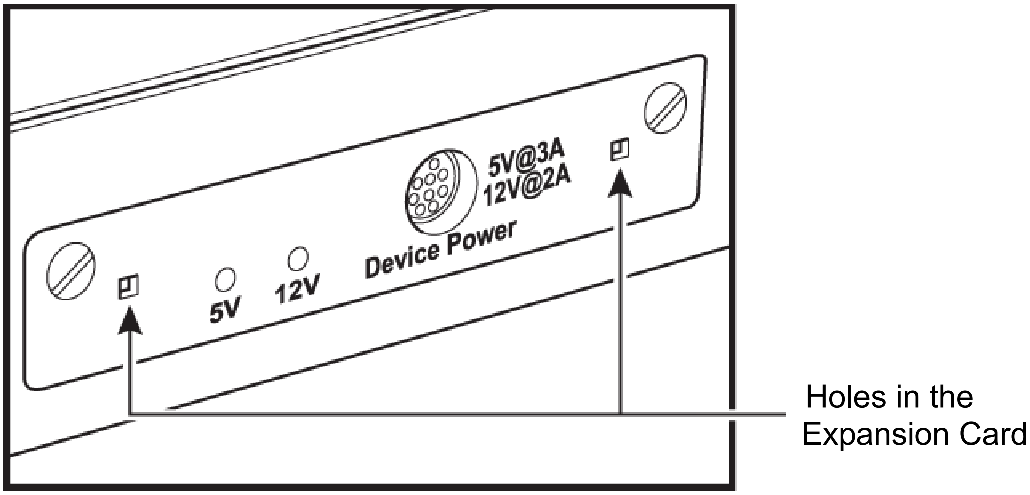
- Standard (flat blade) 3/16” screwdriver
- Teledyne LeCroy Extraction Tool (part number 230-0160-00)




TELEDYNE
LECROY
EXTRACTION TOOL

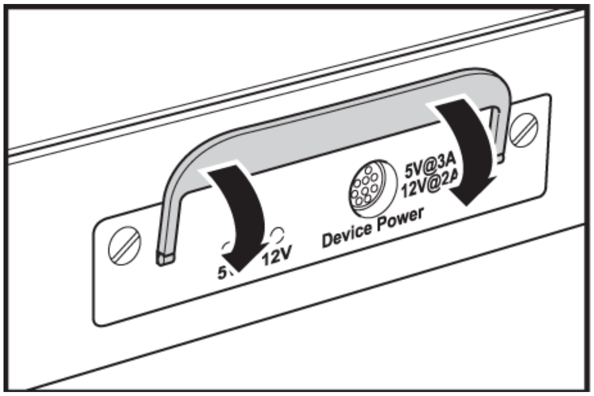
To remove an expansion card, follow these steps:

1. Unplug the system from AC power and turn the system so the expansion port is facing you. Note the two retaining screws and the holes for the extraction tool that are located on the panel of the expansion card.

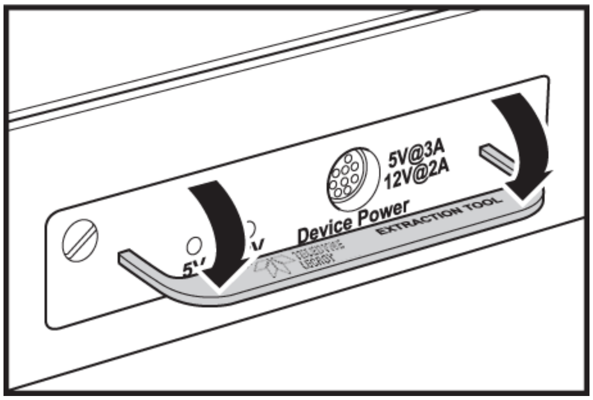

5V@3A
12V@2A
Device Power
5V
12V
Holes in the Expansion Card

2. Insert the extraction-tool prongs into the holes in the expansion card panel.

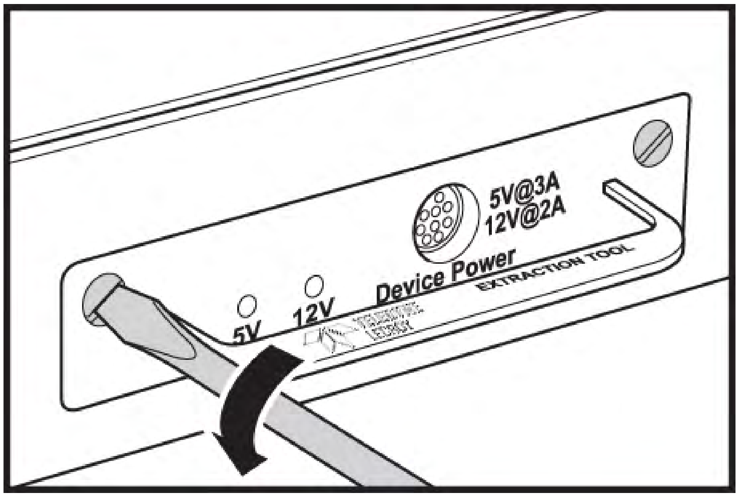
Note: If the prongs do not slip easily into the holes, use a small nail file or similar device to remove paint from the prongs.


5V@3A
12V@2A
Device Power
12V

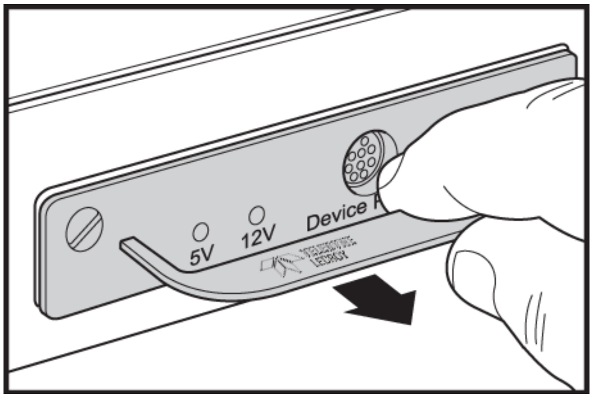
3. Rotate the extraction tool to a horizontal position to lock the prongs into place and make a handle.


5V@3A
12V@2A
Device Power
EXTRACTION TOOL
5V

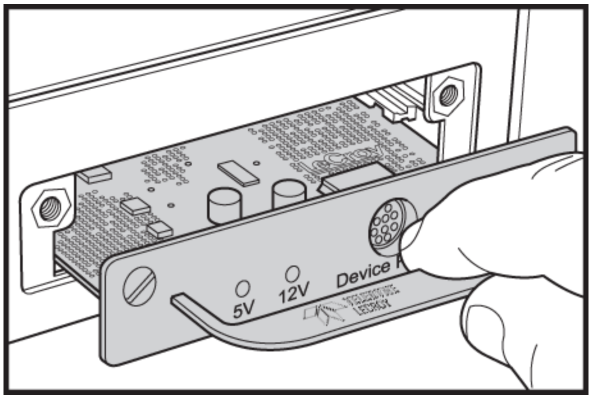
4. Using the screwdriver, loosen both retaining screws by rotating them counter-clockwise approximately two full turns, until feeling slight resistance. **Do not force the retaining screws** after two turns.


5V@3A
12V@2A
Device Power
EXTRACTION TOOL
5V
12V

5. Using the extraction tool as a handle, gently wriggle the expansion card forward about 1⁄8”.


5V
12V
Device

6. Repeat steps 4 and 5 approximately three times, until the card is free from the retaining screws and you can remove the card from the system.


5V
12V
Device P
TELEDYNE LECROY

1.11 Connecting via Ethernet

The Ethernet connection can have any of these configurations:

1. Analyzer connected to a network using a hub or switch, Gigabit Ethernet interface, or similar device.
2. Analyzer connected to the host machine (machine running the application software), using a hub or switch, Gigabit Ethernet interface, or similar device.
3. Analyzer connected directly to the host machine using a crossover cable.

1.12 Connecting to a Network

When connected to a network, the analyzer can communicate with the DHCP server to obtain IP address configuration information in order to establish a connection. Refer to "Select Device" on page 24.

1.13 Connecting over Different Subnets

If the host machine (with the Sierra software) and Sierra M122 are on the same subnet, they will see each other's broadcasts, and the Sierra M122 application will automatically appear in the Select Device dialog, from which you can select a device (as described in the previous section).

If the host machine and Sierra M122 do not reside on the same subnet, they will not see each other automatically. You must add the Sierra M122 IP address manually. To add the IP address, use the Add Device button (see Figure 1.10 on page 26)

TCP and UDP Ports Must be Open to Connect over Ethernet

WARNING: Check your firewall settings before making Ethernet connections. Incorrect firewall settings can prevent Teledyne LeCroy applications from detecting analyzers on the network, though Ping works correctly. Consult your Firewall documentation to allow Teledyne LeCroy applications access to the network.

The following TCP and UDP ports must be open to connect over the Ethernet:

- ☐ **TCP Port**: 4000 to 4003
- ☐ **UDP Ports**: 4015 to 4017

1.14 Launching Your Analyzer

To launch the software, double-click the **SAS** con in the Program Manager Window.

1.15 Operating in Simulation Mode

The SAS applications operate in the Simulation Mode by default if the hardware is not detected.

The Protocol Suite software launches and displays the appropriate tool bar, but with the limitation that the Analyzer operates only on static, previously captured, bus data.

Limitations The Simulation mode lets you try all of the available functions, but keep in mind that the system is not capturing any real data and is displaying only pre-captured results.

1.16 Using the Software

The Sierra M122 application uses the Teledyne LeCroy SAS/SATA Protocol Suite.

The Teledyne LeCroy SAS/SATA Protocol Suite can be a:

- **Protocol Analyzer:** Captures data, triggers on events, and saves. **Easy Mode** allows standard Trigger and Data capture. **Advanced Mode** allows you to program custom triggering in and out, capturing, state jumps, and timers (see “Protocol Analysis” on page 45).

The SAS/SATA application now provides functionality for both protocols. Either protocol can now be accessed via the **File** menu and choosing the protocol to work with. Click **File> New** and select the desired protocol and application.

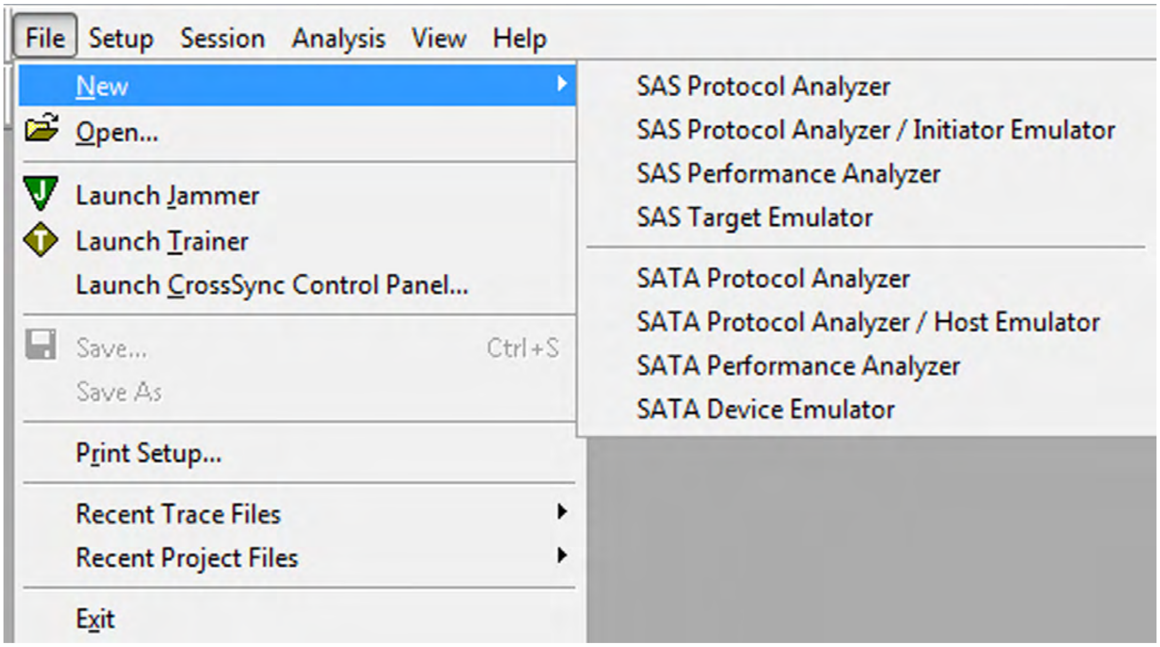

File
Setup
Session
Analysis
View
Help
New
Open...
Launch Jammer
Launch Trainer
Launch CrossSync Control Panel...
Save... Ctrl+S
Save As
Print Setup...
Recent Trace Files
Recent Project Files
Exit
SAS Protocol Analyzer
SAS Protocol Analyzer / Initiator Emulator
SAS Performance Analyzer
SAS Target Emulator
SATA Protocol Analyzer
SATA Protocol Analyzer / Host Emulator
SATA Performance Analyzer
SATA Device Emulator

Figure 1.18: File Menu

To switch between protocols click **Window** and the select the trace or application to use.

Depending on the protocol in use, the relevant functions and menu options are available and the others are greyed out (see Figure 1.19 on page 36).

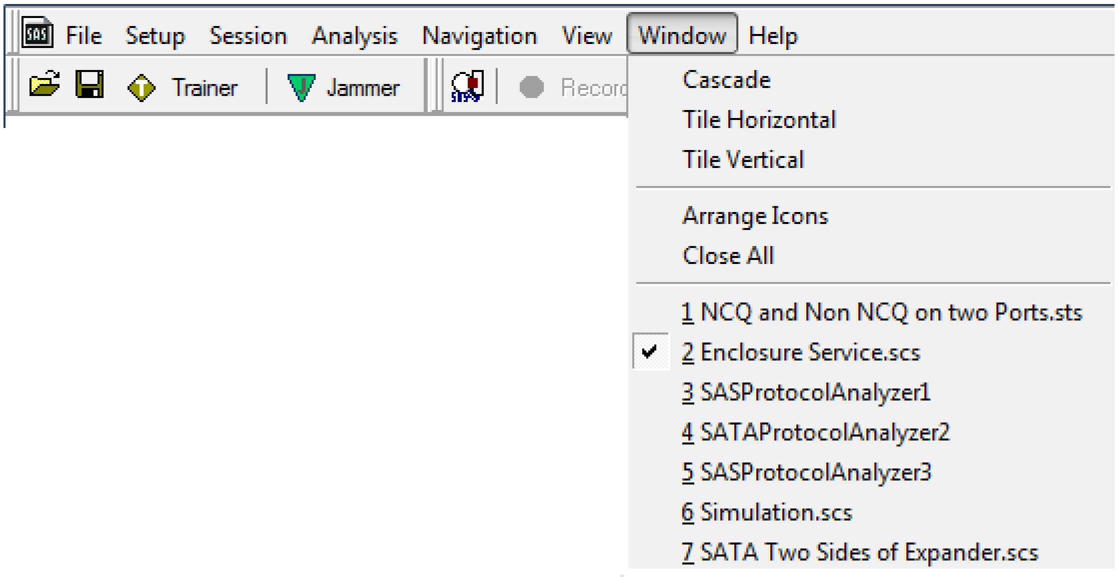

File
Setup
Session
Analysis
Navigation
View
Window
Help
Trainer
Jammer
Record
Cascade
Tile Horizontal
Tile Vertical
Arrange Icons
Close All
1 NCQ and Non NCQ on two Ports.sts
✓ 2 Enclosure Service.scs
3 SASProtocolAnalyzer1
4 SATAProtocolAnalyzer2
5 SASProtocolAnalyzer3
6 Simulation.scs
7 SATA Two Sides of Expander.scs

Figure 1.19: Window Dialog

1.17 Getting Started with the Protocol Analyzer

To use the software for protocol analysis, first select **File > New > Protocol Analyzer** or **File > New > SATA Protocol Analyzer** for a new project or **File > Open** an existing protocol analysis file: .**sac** for a SAS file or .**stc** for a SATA file (see "Protocol Analysis" on page 45). You can also open a **.scs** SAS Sample file or **.sts** SATA Sample file. Example files are in the Examples folder.

On the Capture tab, select to capture **Everything** or **Pattern**. For Pattern, select a Pattern. You can exclude patterns and frames. You can use different patterns for pre-trigger and post-trigger.

On the Trigger tab, select the trigger type. For Pattern, select the pattern.

On the Settings tab, select trigger position and memory use.

Change the Analyzer settings if necessary. Change the port Speed if necessary.

Use Advanced Mode only after you become familiar with the hardware and software and have special needs.

1.18 Menu Options and Toolbars

This section lists all the SAS/SATA Protocol Suite application menu options and the toolbars.

1.18.1 File

The File menu options allows you to perform common tasks such as open, close, save, export, print, send files and exit the application (see Figure 1.20 on page 37).

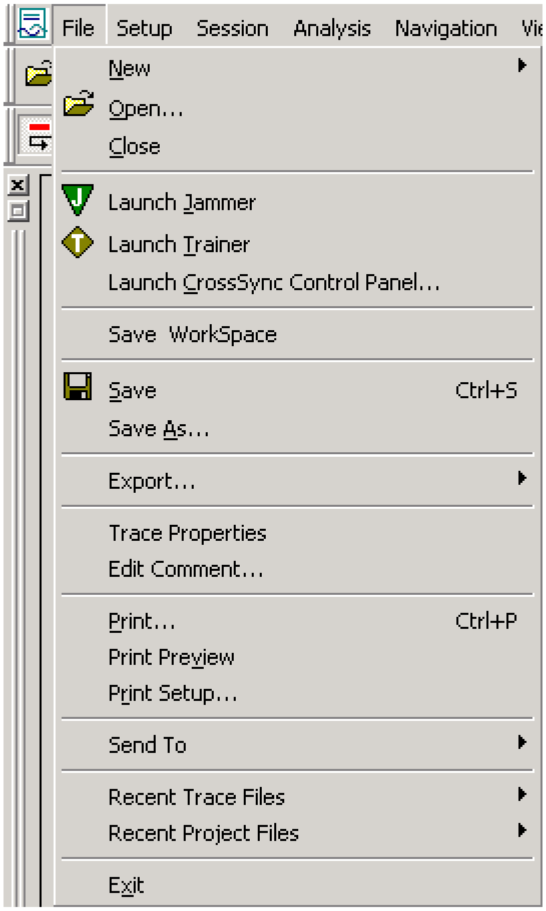

File
Setup
Session
Analysis
Navigation
Vi
New
Open...
Close
Launch Jammer
Launch Trainer
Launch CrossSync Control Panel...
Save WorkSpace
Save Ctrl+S
Save As...
Export...
Trace Properties
Edit Comment...
Print... Ctrl+P
Print Preview
Print Setup...
Send To
Recent Trace Files
Recent Project Files
Exit

Figure 1.20: File Menu Option

1.18.2 Setup

For special work, you can use the Setup menu (see Figure 1.21 on page 38) to perform the following actions:

- ❑ TxRxVout & Pre-emphasis (see “TxRxVout & Preemphasis” on page 244)
- ❑ User Defined Decoding (see “User-Defined Decoding” on page 264)
- ❑ External Trig Setting (see “External Trig Setting” on page 260)
- ❑ Update Device (see “Update Device” on page 261)
- ❑ All Connected Devices (see “Select Device” on page 24)
- ❑ Find DUT finds the Device Under Test (see “Find DUT” on page 269)
- ❑ Power Source Control turns the Device Under Test on and off
- ❑ Manage Setup Licenses (see “Floating License” on page 260)
- ❑ Preferences (see “Preferences” on page 250)
- ❑ Set Port Alias (see “Set Port Alias” on page 242)
- ❑ Set SAS Address Alias (see “SAS Address Alias (SAS only)” on page 243)

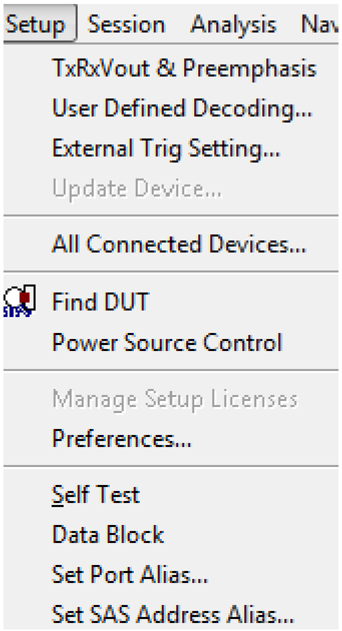

Setup
Session
Analysis
Nav
TxRxVout & Preemphasis
User Defined Decoding...
External Trig Setting...
Update Device...
All Connected Devices...
Find DUT
Power Source Control
Manage Setup Licenses
Preferences...
Self Test
Data Block
Set Port Alias...
Set SAS Address Alias...

Figure 1.21: Setup Menu Option

1.18.3 Session

The Session menu has the following options:

- Start Capture/Record - Start capture or record a trace
- Pause Capture/Record - Aborts the capture without saving
- Stop Capture/Record - Stops the hardware
- Start Target Emulator - Starts the target emulator (SAS)
- Stop Target Emulator - Stops the target emulator (SAS)
- Start Device Emulator - Starts the device emulator (SATA)
- Stop Device Emulator - Stops the device emulator (SATA)

1.18.4 Analysis

The Analysis menu allows you to view captured data (see Figure 1.22 on page 39).

Menu items and toolbar options are enabled or disabled and displayed or hidden based on the type of window open. The following types of windows can be displayed:

- No active window
- Project file open
- Trace file open

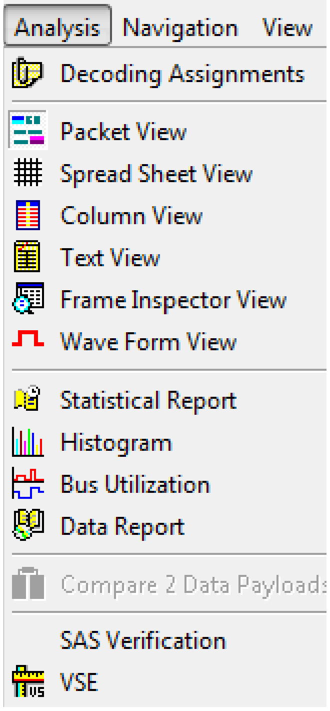

Analysis
Navigation
View
Decoding Assignments
Packet View
Spread Sheet View
Column View
Text View
Frame Inspector View
Wave Form View
Statistical Report
Histogram
Bus Utilization
Data Report
Compare 2 Data Payload
SAS Verification
VSE

Figure 1.22: SAS/SATA Analysis Menu

1.18.5 Viewing Captured Data

Captured data can be displayed in several views. Select **Analysis** from the drop-down menu to access the different views (see “Analysis” on page 124). You can display the same data in:

- ☐ **Packet View**: Displays packets
- ☐ **Spreadsheet View**: Displays Packet View fields by time
- ☐ **Column View**: Displays packets in columns
- ☐ **Text View**: Shows transaction frames, grouped in columns by port
- ☐ **Frame Inspector View:** Has lots of information that is available in Packet View, but not Spreadsheet View, so it is most useful in conjunction with the Spreadsheet View
- ☐ **Waveform Display**: Shows waveform display for all active ports, on which you can perform timing measurements
- ☐ **Statistical Report**: generate statistics for all transports, commands, primitives, bus conditions, addresses, lanes, and errors
- ☐ **Histogram View**: Shows frame-type transfers
- ☐ **Bus Utilization:** Displays the utilization of the bus
- ☐ **Data Reports**: Displays data payloads
- ☐ **Compare 2 Data Payloads**: Compare two data payloads
- ☐ **VSE**: Perform custom post-process analysis of the open trace by running a verification script over the trace

1.18.6 Navigation

The Navigation menu has the following options to navigate through the application (see the following screen capture).

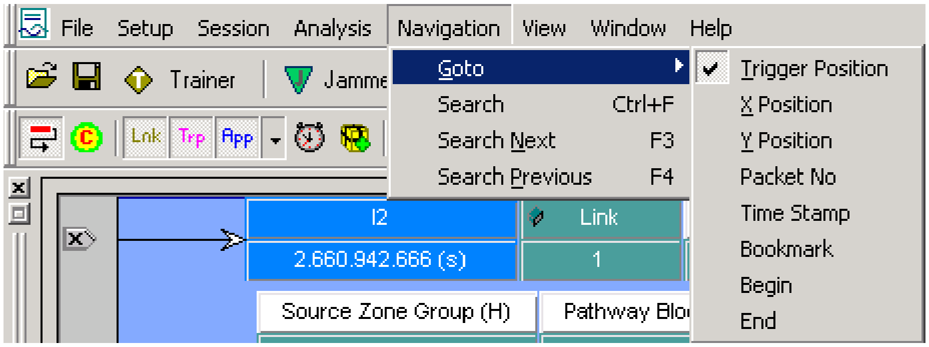

File
Setup
Session
Analysis
Navigation
View
Window
Help
Trainer
Jamme
Goto
Search Ctrl+F
Search Next F3
Search Previous F4
Trigger Position
X Position
Y Position
Packet No
Time Stamp
Bookmark
Begin
End
I2
2.660.942.666 (s)
Link
1
Source Zone Group (H)
Pathway Blo

Figure 1.23: Navigation Menu Option

- ❑ Goto
  - ■ Trigger Position
  - ■ X Position
  - ■ Y Position
  - ■ Packet No
  - ■ Time Stamp
  - ■ Bookmark
  - ■ Begin
  - ■ End
- ❑ Search
- ❑ Search Next
- ❑ Search Previous

1.18.7 View

The View menu options (see Figure 1.24 on page 41) allows the user to zoom in and out, enable/disable filtering and toolbars among other actions. It has the following options.

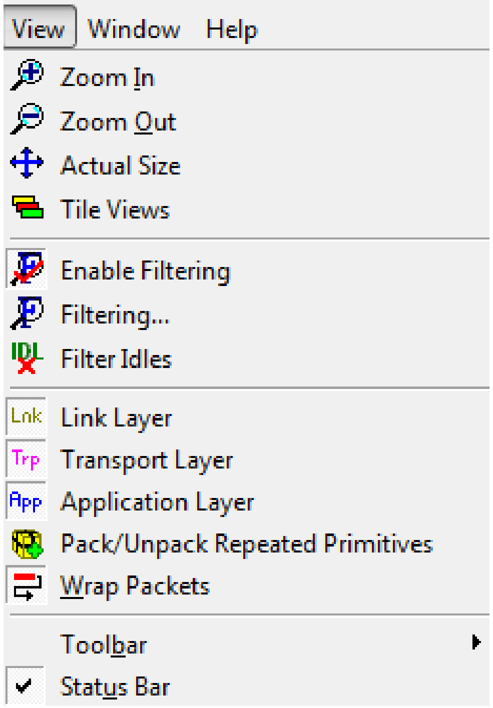

View
Window
Help
Zoom In
Zoom Out
Actual Size
Tile Views
Enable Filtering
Filtering...
Filter Idles
Link Layer
Transport Layer
Application Layer
Pack/Unpack Repeated Primitives
Wrap Packets
Toolbar
Status Bar

Figure 1.24: View Menu Option

- ❑ Zoom In (refer to "Navigation + View Toolbar" on page 202)
- ❑ Zoom Out (refer to "Navigation + View Toolbar" on page 202)
- ❑ Actual Size (refer to "Navigation + View Toolbar" on page 202)
- ❑ Tile Views (refer to "Navigation + View Toolbar" on page 202))
- ❑ Enable Filtering (refer to "Filter Setup" on page 208)
- ❑ Filtering (refer to "Filter Setup" on page 208)
- ❑ Filter Idles (refer to "Filter Setup" on page 208)
- ❑ Link Layer-SAS only (refer to "Packet View Toolbar" on page 226)
- ❑ Transport Layer-SAS only (refer to "Packet View Toolbar" on page 226)
- ❑ Application Layer-SAS only (refer to "Packet View Toolbar" on page 226)
- ❑ Pack/Unpack Repeated Primitives-SAS only (refer to "Packet View Toolbar" on page 226)
- ❑ Physical Layer-SATA only (refer to "Packet View Toolbar" on page 226)
- ❑ FIS Layer-SATA only (refer to "Packet View Toolbar" on page 226)
- ❑ Command Layer-SATA only (refer to "Packet View Toolbar" on page 226)
- ❑ Wrap Packets (refer to (refer to "Packet View Toolbar" on page 226)
- ❑ Tool bar (allows you to customize the toolbar with the options given below)
  - ■ Main
  - ■ Record+Capture
  - ■ Analysis
  - ■ Navigation+View
  - ■ Packet View
  - ■ Column View
  - ■ Cursor position
  - ■ Target Emulator

- Status Bar (refer to "Cursor Position Status Bar" on page 237)

1.18.8 Window

The Window menu has the following options:

- **Cascade:** Displays all open windows in an overlapping arrangement.
- **Tile Horizontal:** Displays all open windows in a above-below arrangement.
- **Tile Vertical:** Displays all open windows in a side-by-side arrangement.
- **Arrange Icons:** Arranges minimized windows at the bottom of the display.
- **Close All:** Closes all windows.

1.18.9 Help

For more information see "Help Menu" on page 266.

1.18.10 Toolbars

The toolbars enable you to perform several actions, some of which are listed below.

- Show or hide fields and ports, change port names, and change data format.
- Show the layers and channels using their toolbars.
- Decode using the Decode toolbar.
- Search and Filter.

There are five sets of toolbars (see Figure 1.25 on page 43):

- Main Toolbar - For details on the Main Toolbar refer to "SAS Main Toolbar" on page 49 and "SATA Main Toolbar" on page 49.
- Record Capture Toolbar - For additional information see "SAS Main Toolbar" on page 49 and "SATA Main Toolbar" on page 49.
- Navigation + View Toolbar - For additional information see "Navigation + View Toolbar" on page 202.
- Show Analysis Toolbar - For additional information see "Show Analysis Toolbar" on page 124.
- Packets View Toolbar - For additional information see "Packet View Toolbar" on page 226.
- Column View - For additional information see "Column View" on page 143.
- Cursor Position- For additional information see "Using the Cursors and Bookmarks" on page 237.

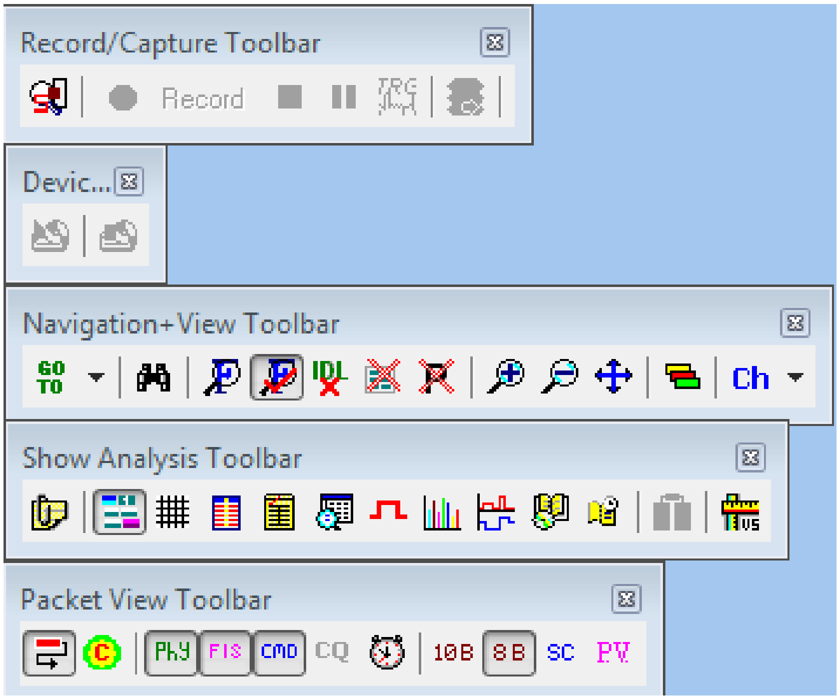


Figure 1.25: SAS/SATA Protocol Suite Toolbars

1.19 Port Status

You can display an overview of the active ports by clicking the buttons at the bottom right of the main window (see “Port Status” on page 235).

1.20 InFusion

The Teledyne LeCroy InFusion™ Error Injector and Traffic Modifier is an error injector and traffic modification tool for traffic passing through the Jammer. It allows you to verify real-world fault handling for Serial Attached SCSI (SAS) and Serial ATA (SATA) systems. Click on the Jammer icon Jammer to invoke the Teledyne LeCroy SAS or SATA InFusion, see “InFusion Overview” on page 283.

You can toggle between the InFusion and Analyzer panes by using the Alt+Tab keys, the Windows Task Bar or by pressing the respective toolbar button in each pane.

1.21 Trainer

The SAS *Trainer* is a traffic generator that can emulate a SAS initiator/target or SATA host/device. Traffic generation enables engineers to test designs under realistic conditions and to transmit known errors, allowing engineers to observe how devices handle faulty link conditions.

Traffic generation is performed via the execution of text-based scripts. These traffic generation files (*.**ssg**) contain statements about the types of traffic to be generated. These script files can be edited with either a simple text editor such as Notepad or with the included Script Editor utility.

Click on the Trainer icon Trainer to invoke the Teledyne LeCroy SAS or SATA Trainer, see “Sierra Trainer Traffic Generation” on page 357.

You can toggle between the Trainer and Analyzer panes by using the Alt+Tab keys, the Windows Task Bar or by pressing the respective toolbar button in each pane.

Note: When it runs, the trainer turns on the voltage on all channels, whether they are turned on or off previously.

Chapter 2

Protocol Analysis

A default analyzer project is created automatically when the application starts. An analyzer project contains all the settings for capturing, triggering and memory usage. A project can be saved as a ***.sac** files for later use.

2.1 Easy Mode (Pre-Defined Setups)

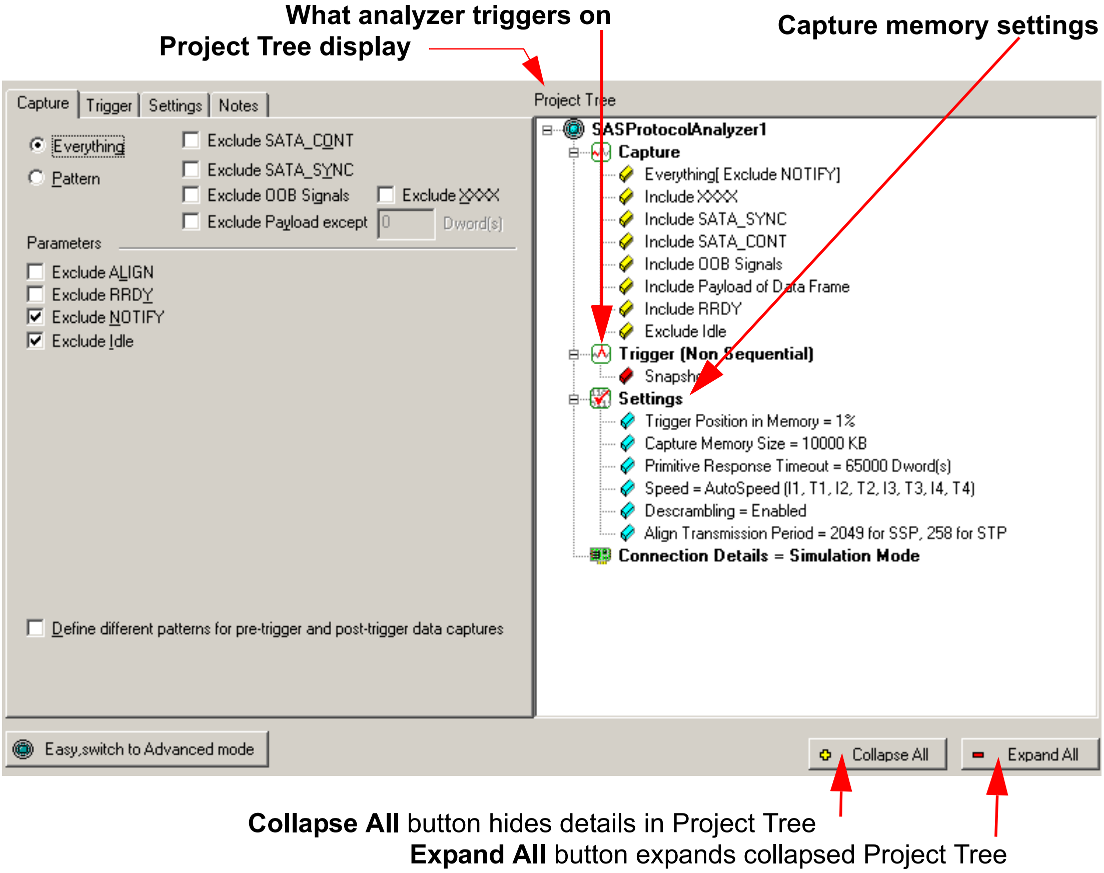
After you install the Protocol Suite software (see "Software Installation" on page 20) and set up the Analyzer (see "Hardware Setup" on page 21), launch the Protocol Suite software (see "Launching Your Analyzer" on page 34) to display the default Protocol Analyzer in Easy Mode at the Capture tab.

The default Protocol Analyzer uses the Easy Mode which allows triggering and data capture.

2.1.1 Main Window

Use the Easy Mode to get a comprehensive overview of your analyzer's capabilities. Use the default Analyzer Project or create a new project.

For **SAS**: on the Analyzer Menu Bar, click **File > New > SAS Protocol Analyzer** to open a SAS Protocol Analyzer dialog.


What analyzer triggers on

Project Tree display

Capture memory settings

● Everything

○ Pattern

☐ Exclude SATA_CONT

☐ Exclude SATA_SYNC

☐ Exclude OOB Signals

☐ Exclude XXXX

☐ Exclude Payload except 0 Dword(s)

Parameters

☐ Exclude ALIGN

☐ Exclude RRDY

☑ Exclude NOTIFY

☑ Exclude Idle

☐ Define different patterns for pre-trigger and post-trigger data captures

Project Tree

- SASProtocolAnalyzer1
  - Capture
    - Everything[Exclude NOTIFY]
    - Include XXXX
    - Include SATA_SYNC
    - Include SATA_CONT
    - Include OOB Signals
    - Include Payload of Data Frame
    - Include RRDY
    - Exclude Idle
  - Trigger (Non Sequential)
    - Snapshot
  - Settings
    - Trigger Position in Memory = 1%
    - Capture Memory Size = 10000 KB
    - Primitive Response Timeout = 65000 Dword(s)
    - Speed = AutoSpeed (I1, T1, I2, T2, I3, T3, I4, T4)
    - Descrambling = Enabled
    - Align Transmission Period = 2049 for SSP, 258 for STP
  - Connection Details = Simulation Mode

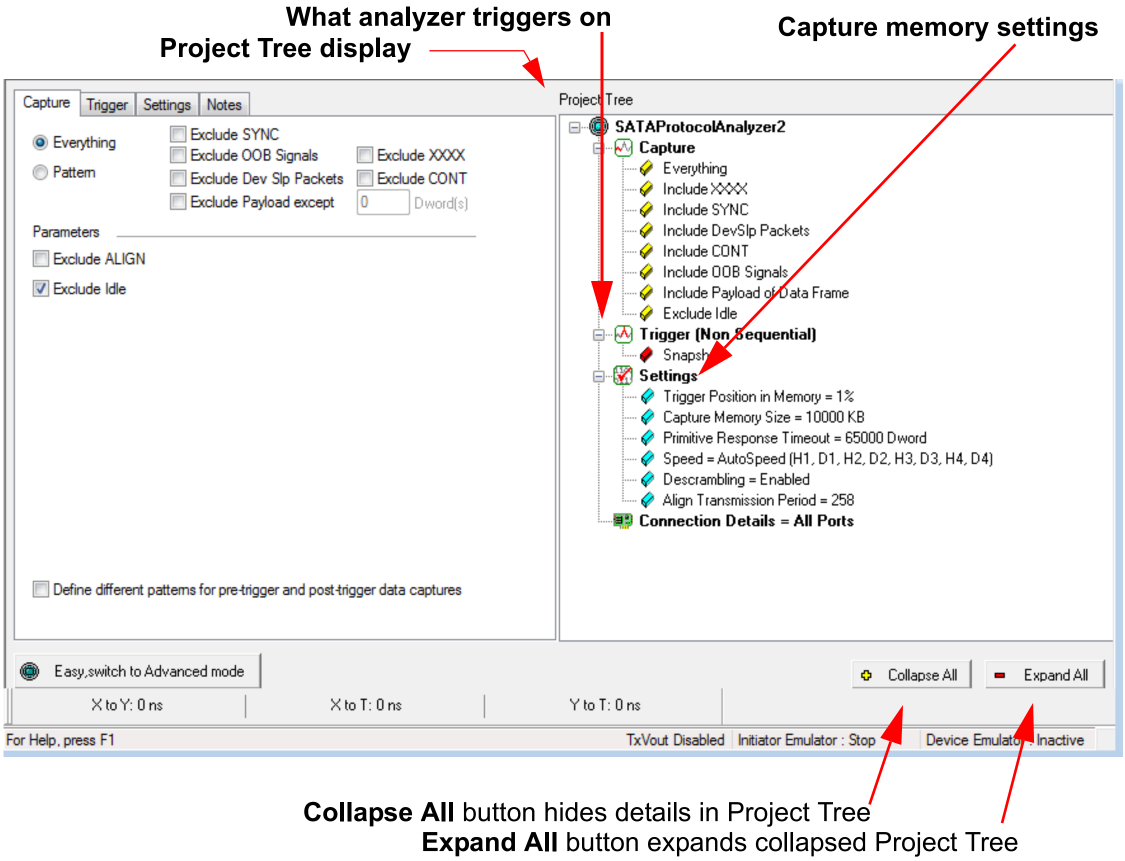
Collapse All button hides details in Project Tree

Expand All button expands collapsed Project Tree

Figure 2.1: SAS: New Analysis Project Dialog

The New Project dialog opens with default settings to capture Everything on the bus and to Trigger On on Snapshot. (The analyzer captures everything immediately without triggering on anything in particular.)

For **SATA:** On the Analyzer Menu Bar, click **File > New > SATA Protocol Analyzer** to open a SATA Protocol Analyzer dialog.



● Everything
○ Pattern

☐ Exclude SYNC
☐ Exclude OOB Signals
☐ Exclude XXXX
☐ Exclude Dev Slp Packets
☐ Exclude CONT
☐ Exclude Payload except 0 Dword(s)

Parameters

☐ Exclude ALIGN
☑ Exclude Idle

☐ Define different patterns for pre-trigger and post-trigger data captures

SATAProtocolAnalyzer2
- Capture
  - Everything
  - Include XXXX
  - Include SYNC
  - Include DevSlp Packets
  - Include CONT
  - Include OOB Signals
  - Include Payload of Data Frame
  - Exclude Idle
- Trigger (Non Sequential)
  - Snapshot
- Settings
  - Trigger Position in Memory = 1%
  - Capture Memory Size = 10000 KB
  - Primitive Response Timeout = 65000 Dword
  - Speed = AutoSpeed (H1, D1, H2, D2, H3, D3, H4, D4)
  - Descrambling = Enabled
  - Align Transmission Period = 258
- Connection Details = All Ports

X to Y: 0 ns X to T: 0 ns Y to T: 0 ns

For Help, press F1 TxVout Disabled Initiator Emulator : Stop Device Emulator : Inactive

Collapse All button hides details in Project Tree
Expand All button expands collapsed Project Tree

Figure 2.2: SATA: New Analysis Project Dialog

SAS vs. SATA: SATA Dialog does not show “Exclude RRDY” or “Exclude NOTIFY”. SATA Dialog replaces “Exclude SATA_CONT” with “Exclude CONT” and “Exclude SATA_SYNC” with “Exclude SYNC”.

2.1.2 Project Tree

The Project Tree on the right side of the main window displays a comprehensive tree structured overview of the project. The project tree shows the capture configuration, trigger setups, and the capture memory settings.

Capture Tab Fields

The Capture tab has the following fields:

Exclude SATA_CONT (SAS) or Exclude CONT (SATA)

Check this to exclude SATA_CONT primitives from the data capture.

Exclude SATA_SYNC (SAS) or Exclude SYNC (SATA)

Check this to exclude SATA_SYNC primitives from the data capture.

Exclude OOB Signals

Check this to exclude OOB signals from the data capture.

Exclude XXXX

Check this to exclude XXXX patterns from the data capture.

Note: The validity of time stamps during Idles is traded off against good buffer memory utilization when using ‘Exclude XXXX’.

Exclude Dev Slp Packets (SATA)

Check this to exclude Dev Slp Packets from the data capture.

Exclude Payload except

Check this to exclude Payload of Data Frames from the data capture. You can except a number of DWORD(s).

Note: The Data Report (refer to “Data Report” on page 186) does not reflect excluded Payload of Data Frames.

Note: When showing truncated data in the Data Payload View, the truncation points are marked with a separator placed between payloads. You can get more information about the data exclusion using the tooltip over the separator.

Exclude ALIGN

Check this to exclude ALIGN primitives from the data capture.

Exclude RRDY (SAS only)

Check this to exclude RRDY primitives from the data capture.

Exclude NOTIFY (SAS only)

Check this to exclude NOTIFY primitives from the data capture.

Exclude Idle

Check this to exclude Idles from the data capture.

Define different patterns for pre-trigger and post-trigger data captures

Replaces the Capture tab with a Pre-Trigger Capture tab and a Post-Trigger Capture tab.

2.2 SAS/SATA Software Menus and Toolbars

The SAS/SATA software has the following menus and toolbars.

Note: The sections "SAS Main Toolbar" and "SATA Main Toolbar" are shown separately to indicate the different context sensitive toolbar options depending on whether SAS or SATA trace or project is open.

2.2.1 SAS Main Toolbar

The following figure displays the SAS main toolbar.

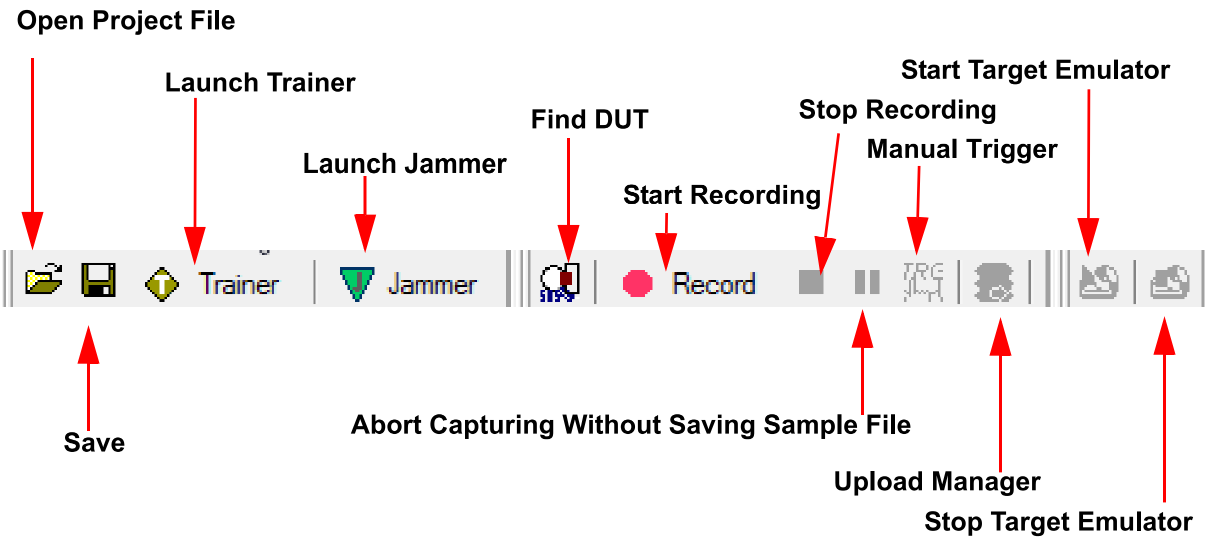

Open Project File
Launch Trainer
Launch Jammer
Find DUT
Start Recording
Stop Recording
Manual Trigger
Start Target Emulator
Trainer
Jammer
Record
Save
Abort Capturing Without Saving Sample File
Upload Manager
Stop Target Emulator

Figure 2.3: SAS: Software Menus and Toolbar

2.2.2 SATA Main Toolbar

The following figure displays the SATA main toolbar.

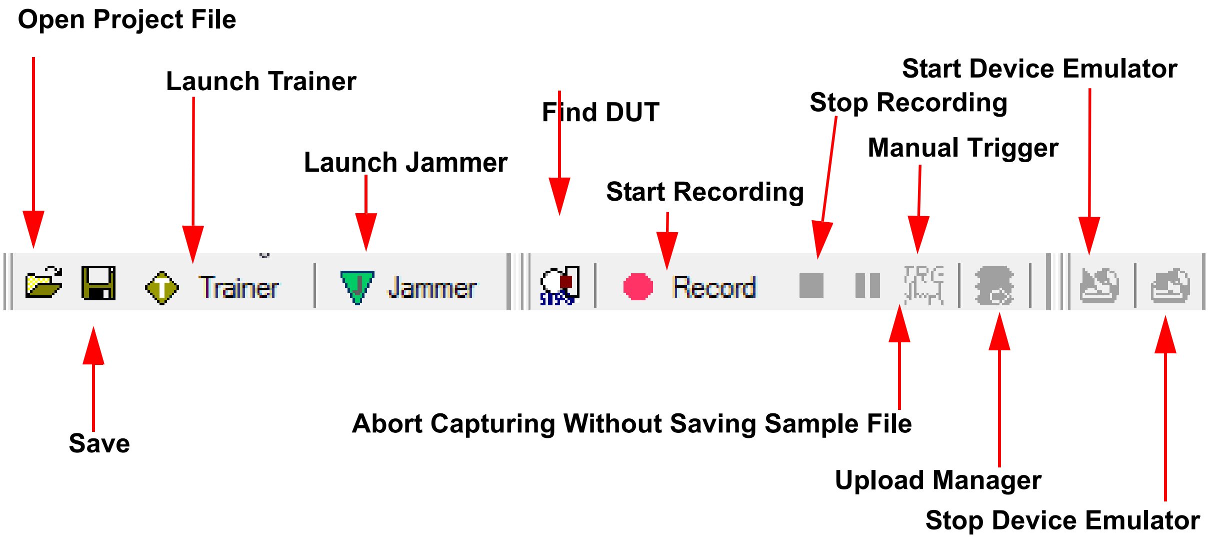

Open Project File
Launch Trainer
Launch Jammer
Find DUT
Start Recording
Stop Recording
Manual Trigger
Start Device Emulator
Trainer
Jammer
Record
Save
Abort Capturing Without Saving Sample File
Upload Manager
Stop Device Emulator

Figure 2.4: SATA: Software Menus and Toolbar

2.2.3 Start Recording

To get an immediate overview of the bus traffic to and from your Analyzer:

1. Click the ● Record **Record** button.
2. The analyzer begins filling the defined memory buffer with traffic captured from the bus. After the traffic fills the memory buffer, the traffic is uploaded to the viewer and the Packet View display opens. Packet View is the default display. However, more views are available by selecting **View** on the menu bar and choosing the desired View.

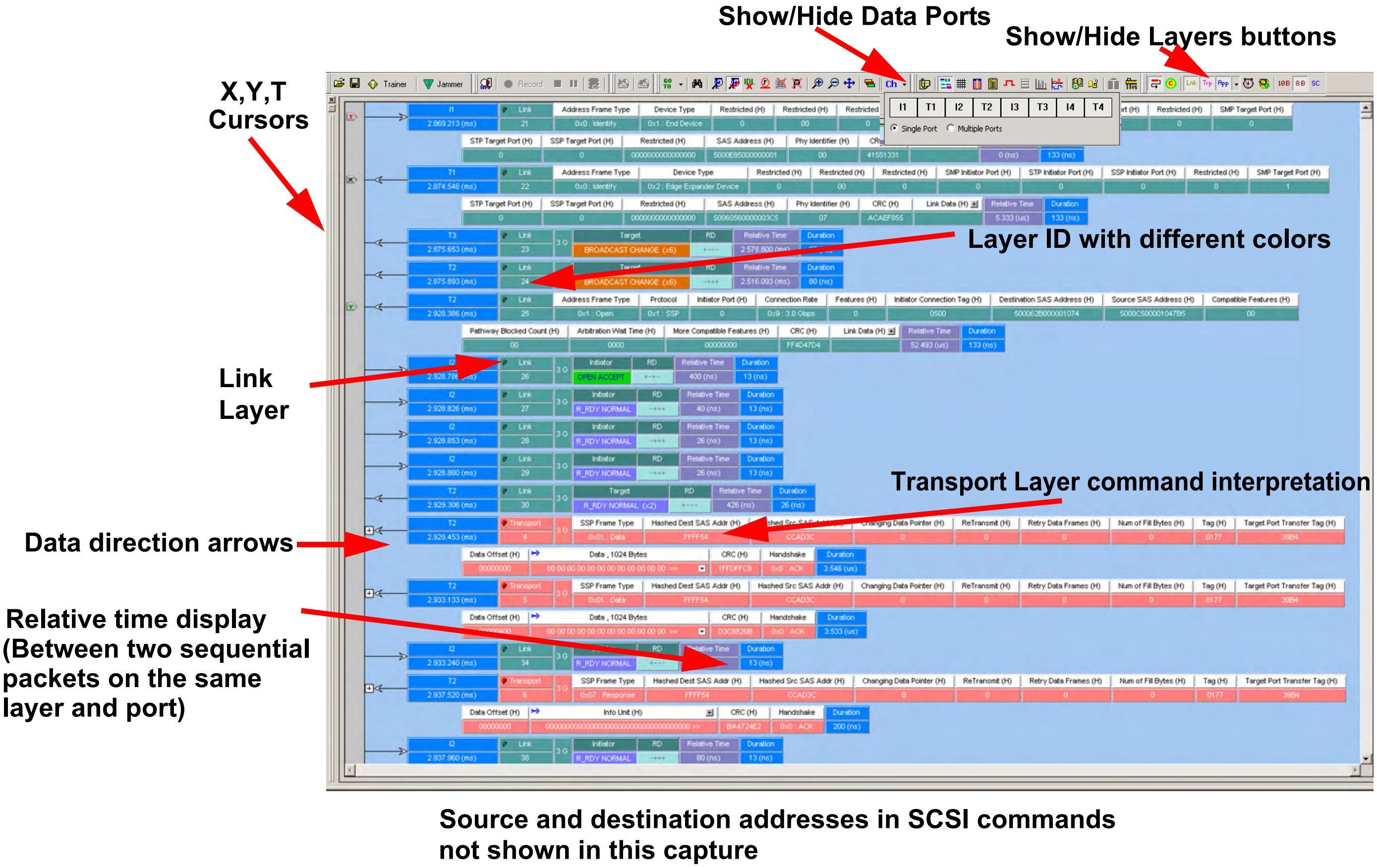

Show/Hide Data Ports
Show/Hide Layers buttons
X,Y,T Cursors
Layer ID with different colors
Link Layer
Transport Layer command interpretation
Data direction arrows
Relative time display (Between two sequential packets on the same layer and port)
Source and destination addresses in SCSI commands not shown in this capture

Figure 2.5: SAS: Typical Packet View

Note: When using the Advanced Mode sequencer, the analyzer logs the state transitions in the trace, with the name the user gives to the state.

In the Packet View, right-click on any packet and select **Show->State**, to display the states and their transitions in the trace.

SAS: In case of an STP interface, the expander displays STP addresses provided to the SATA drive and the SAS software integrates the STP addresses in the ATA command.

The results display shows each transaction for every layer identified in a different color and the data direction identified with data direction arrows. Upstream traffic has an arrow from right to left: ⇐. Downstream traffic has an arrow left to right: ⇒.

Layers can be hidden by clicking the corresponding **Show/Hide** button on the menu bar. The system retains all captured data, but the display has fewer data layers for simpler viewing.

You can configure the viewer display for test and viewing preferences (see “Viewer Display” on page 121 for details about configuring the viewer display).

The Analysis Project dialog offers you a comprehensive set of choices to create a trigger and capture project satisfying some specific need. You can set the Analyzer to:

- ❑ Capture specific patterns (see “Patterns and Data Capture Setup” on page 63).
- ❑ Capture different patterns pre- and post-trigger.
- ❑ Exclude parameters from capture.
- ❑ Trigger on a pattern or sequence of patterns (see "Trigger Setup" on page 78).
- ❑ Configure trace capture memory (Settings tab).
- ❑ Select file to save trace capture in memory (Settings tab).
- ❑ Include a project note (Notes tab).

2.2.4 Launch Jammer

The Launch Jammer option invokes InFusion. For more information refer to “InFusion Overview” on page 283.

2.2.5 Launch Trainer

The Launch Trainer option invokes Trainer. For more information refer to “Sierra Trainer Traffic Generation” on page 357.

2.2.6 CrossSync Control Panel

The CrossSync Control Panel allows you to select analyzers for synchronization and manage the recording process. It supports a wide combination of Teledyne LeCroy’s flagship analyzers including PCI Express, USB, DDR, Serial ATA (SATA), Serial Attached SCSI (SAS), Fibre Channel (FC) and Ethernet.

CrossSync is Teledyne LeCroy’s analyzer synchronization solution that enables time-aligned display of protocol traffic from multiple daisy-chained analyzers showing packet traffic from multiple high-speed serial busses. A lightweight software control panel allows users to select analyzers for synchronization and manage the recording process. Captured traffic is displayed using the latest Protocol Suite software (in separate windows) with all the protocol specific search and reporting features.

Captured packets are displayed in separate windows that share a common time scale. Navigating the traffic in either direction will scroll to the same timestamp in a synchronized window. When using the CrossSync option, users can access the full complement of analysis capabilities available within the individual Teledyne LeCroy software. Search, reporting, and decoding all operate normally.

This feature is available with the Teledyne LeCroy SAS/SATA Protocol Suite application.

Launching the CrossSync Control Panel

To launch CrossSync from the SAS/SATA Protocol Suite software application, click on **File** and select **Launch CrossSync Control Panel** (see Figure 2.6 on page 52). Or, you can launch CrossSync from the '**Start**' menu.

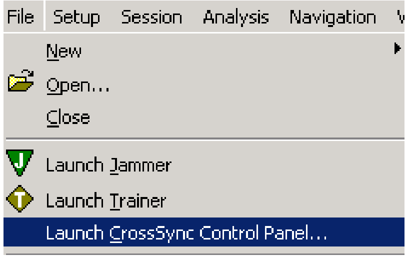


Figure 2.6: Launching CrossSync from the SAS/SATA Protocol Suite Application

Please refer to the ***CrossSync Control Panel User Manual*** for more information.

2.2.7 Save Workspace

Viewing parameters can be saved in a workspace as a **.wss** file.

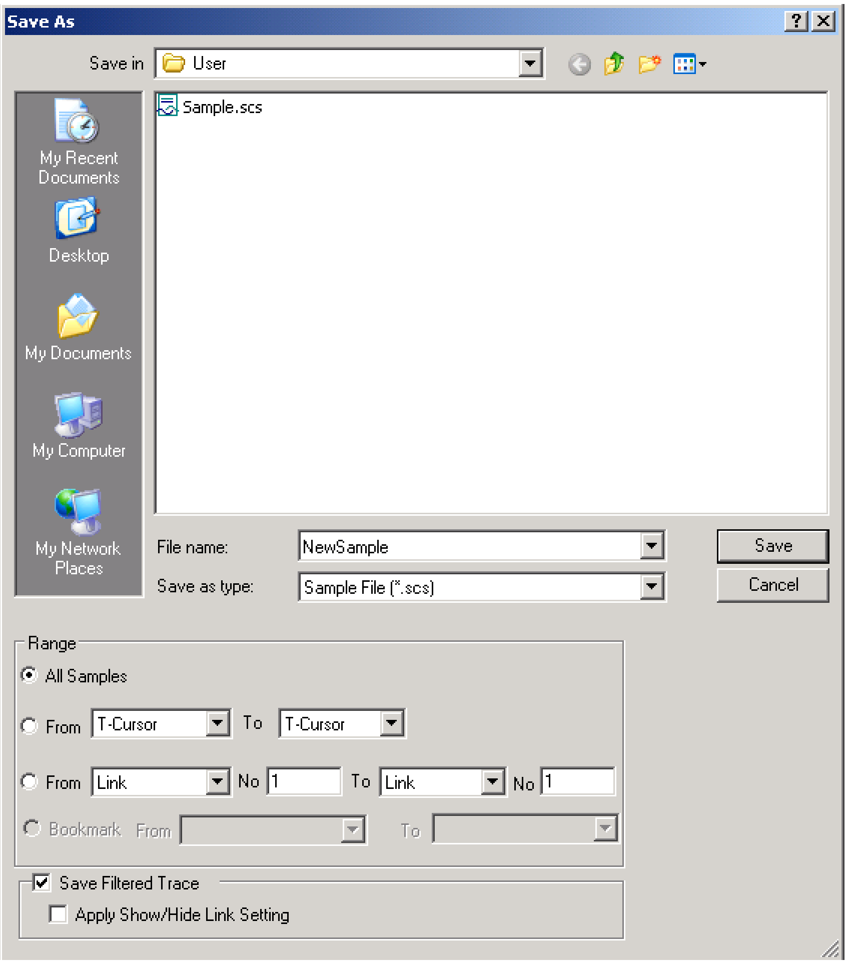
After you open a trace and select views, you can save the viewing parameters in a workspace file. Select **File > Save Workspace** to open a Save As dialog. Save the current workspace as a **.wss** file.

To set default workspace viewing parameters, select **Setup > Preferences** . In the Default Workspace field, enter the path and name of a saved workspace **.wss** file.

The workspace can be switched after opening a trace file. Select **File > Open** to open another workspace and select a **.wss** file.

2.2.8 Saving a Trace Capture

You can save a Trace Capture by selecting **Save** from the **File** menu, or select **Save As** to save as the trace capture for review at a later time using the following dialog.


Save As
My Recent Documents
Desktop
My Documents
My Computer
My Network Places
Sample.scs
Save
Cancel
Range
Bookmark From To

Save in: User

File name: NewSample

Save as type: Sample File (*.scs)

● All Samples

○ From T-Cursor To T-Cursor

○ From Link No 1 To Link No 1

☑ Save Filtered Trace

☐ Apply Show/Hide Link Setting

Figure 2.7: Save As Dialog

You can limit the range of the saved file. You can save:

- All Samples
- Range between selected cursors
- Range between selected Idle, link, commands
- Range between bookmarks

The **Save Filtered Sample** checkbox saves a trace file without filtered data. The **Apply Show/Hide Link Setting** checkbox filters the saved data further by also applying the current status of the port buttons of the toolbar.

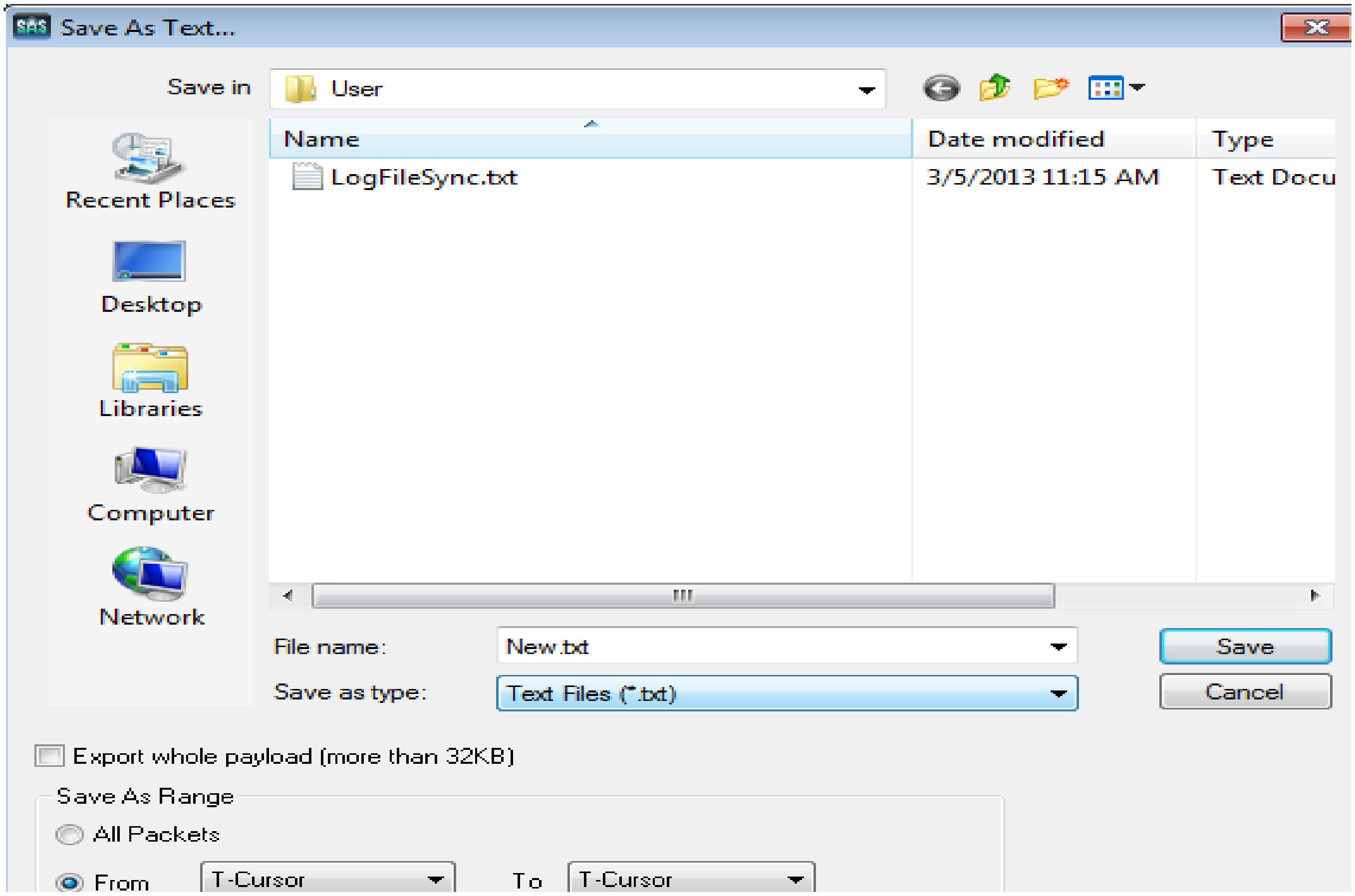
2.2.9 Exporting

From the File menu, you can Export to Text/Excel, Export Read-Write Command Report, or Export Paired SAS Address Report.

Note: Export to Text/Excel is available from the Spreadsheet View, Packet View or Text View as of S/W version 5.60 or later. Export to Text/Excel is not available from Column View as of S/W version 5.60 or later.

Export to Text/Excel

From the File menu, you can export to Text/Excel, using the **Export to Text/Excel.** The **Save as Text** dialog displays.


Save As Text...
Recent Places
Desktop
Libraries
Computer
Network
Save
Cancel

Save in: User

Name	Date modified	Type
LogFileSync.txt	3/5/2013 11:15 AM	Text Docu

File name: New.txt

Save as type: Text Files (*.txt)

☐ Export whole payload (more than 32KB)

Save As Range

○ All Packets

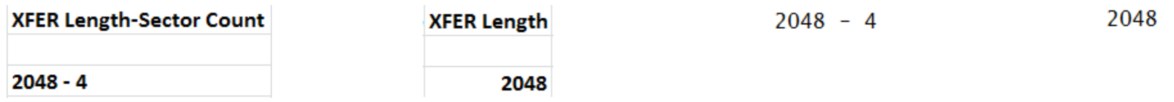
● From T-Cursor To T-Cursor

Figure 2.8: Save As Text Dialog.

- From the Save as type: drop-down select Text Files.txt or Text Files Version 1.0 .txt for text format or Excel File.csv or Excel Files Version 1.0.csv for Excel format (see “Save As Display Formats” on page 54).
- Check the box **Export the whole payload (more than 32KB)** to export the whole payload (more than 32KB).
- You can limit the range of the saved file. You can save:
  - All Packets
  - Range between selected cursors
- Range between bookmarks

Save As Display Formats

The following figure describes the four different Save As type formats:


XFER Length-Sector Count
2048 - 4
XFER Length
2048
2048 - 4
2048

Excel File.csv format Excel Files Version 1.0.csv format Text Files.txt format Text Files Version 1.0.txt format

Export to Initiator Emulator (SAS) or Host Emulator (SATA)

From the File menu, you can Export to Initiator Emulator (SAS) or Export to Host Emulator (SATA), using the Extract Sample File dialog (see following figures).

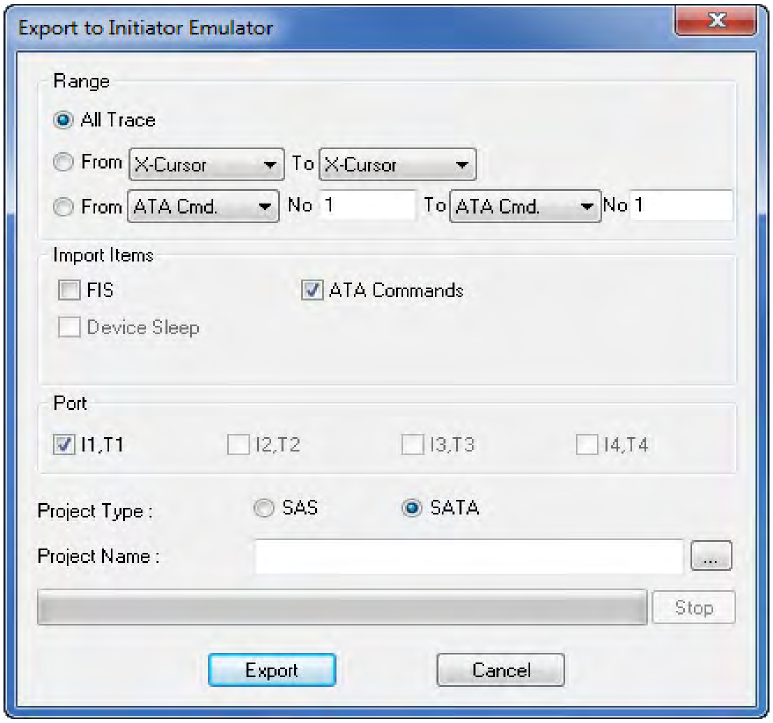

Export to Initiator Emulator
Range
● All Trace
○ From X-Cursor To X-Cursor
○ From ATA Cmd. No 1 To ATA Cmd. No 1
Import Items
☐ FIS
☑ ATA Commands
☐ Device Sleep
Port
☑ I1,T1
☐ I2,T2
☐ I3,T3
☐ I4,T4
Project Type : ○ SAS ● SATA
Project Name :
...
Stop
Export
Cancel

Figure 2.9: Export to Initiator Emulator (SATA) Dialog.

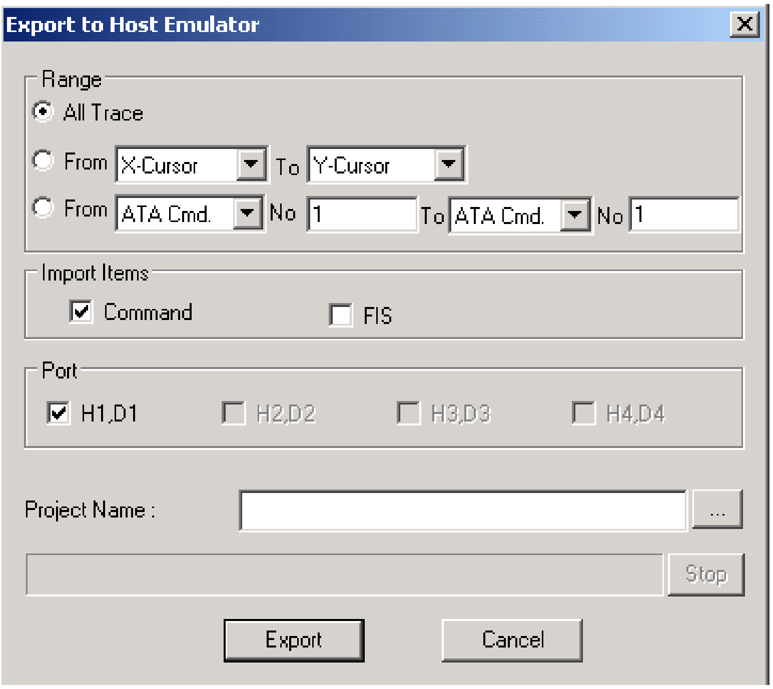

Export to Host Emulator
Range
● All Trace
○ From X-Cursor To Y-Cursor
○ From ATA Cmd. No 1 To ATA Cmd. No 1
Import Items
☑ Command
☐ FIS
Port
☑ H1,D1
☐ H2,D2
☐ H3,D3
☐ H4,D4
Project Name :
...
Stop
Export
Cancel

Figure 2.10: Export to Host Emulator (SATA) Dialog.

You can limit the range of the saved file. You can save:

- All Trace
- Range between selected cursors
- Range between SCSI Commands or Transport

You can export SCSI Commands, Task Management, FIS, ATA Commands, Device Sleep, SSP Frames, SMP Frames, SMP Commands, or STP Frames.

You can select the **Port**.

In the **Project Name**, enter a valid file name.

2.2.10 Export to Trainer

The Export to Trainer dialog, accessible from the File menu, allows exporting data to a file in a format supported by the Trainer. See Figure 2.11 and Figure 2.12 on page 57.

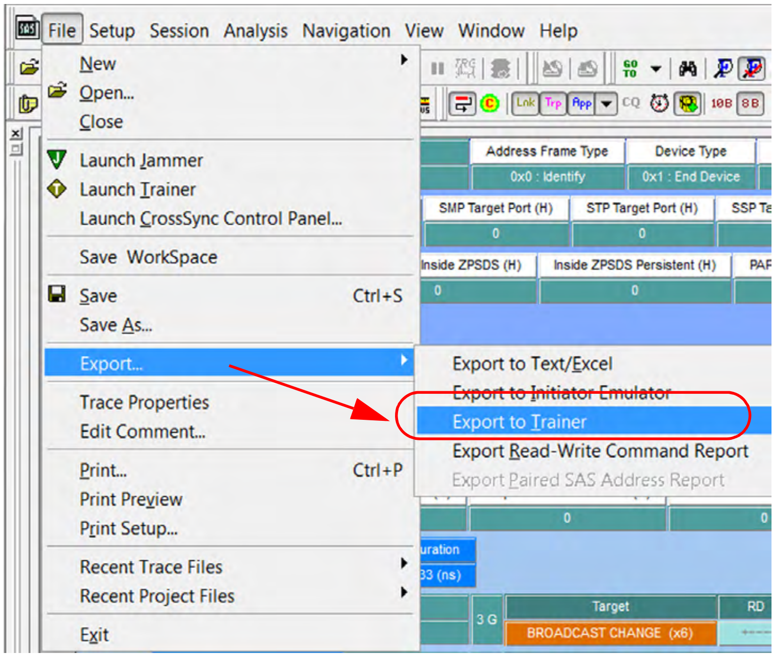
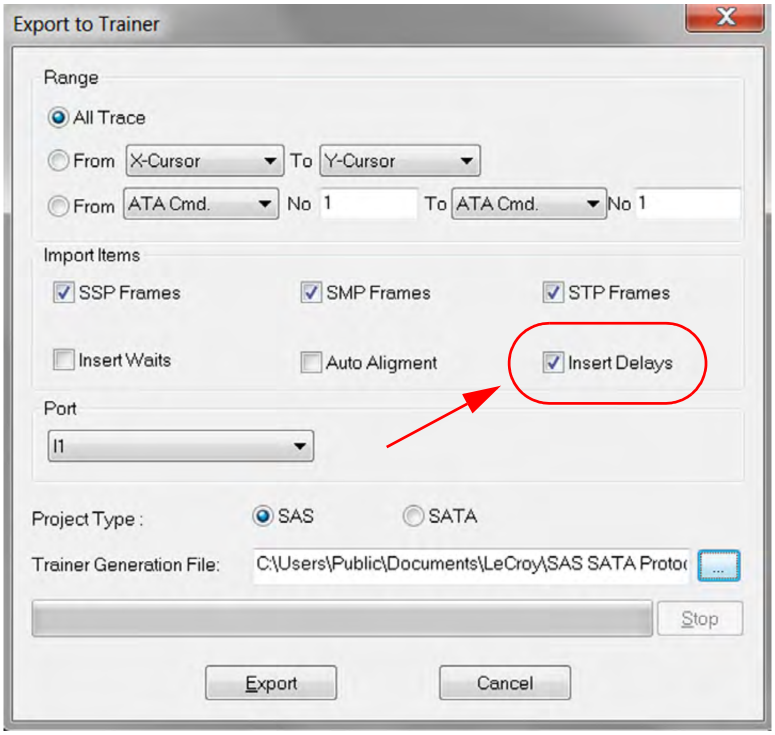

File
Setup
Session
Analysis
Navigation
View
Window
Help
New
Open...
Close
Launch Jammer
Launch Trainer
Launch CrossSync Control Panel...
Save WorkSpace
Save Ctrl+S
Save As...
Export...
Trace Properties
Edit Comment...
Print... Ctrl+P
Print Preview
Print Setup...
Recent Trace Files
Recent Project Files
Exit
Export to Text/Excel
~~Export to Initiator Emulator~~
Export to Trainer
Export Read-Write Command Report
Export Paired SAS Address Report
Address Frame Type
Device Type
0x0 : Identify
0x1 : End Device
SMP Target Port (H)
STP Target Port (H)
Inside ZPSDS (H)
Inside ZPSDS Persistent (H)
Target
BROADCAST CHANGE (x6)

Figure 2.11: Export to Trainer Dialog (SAS)



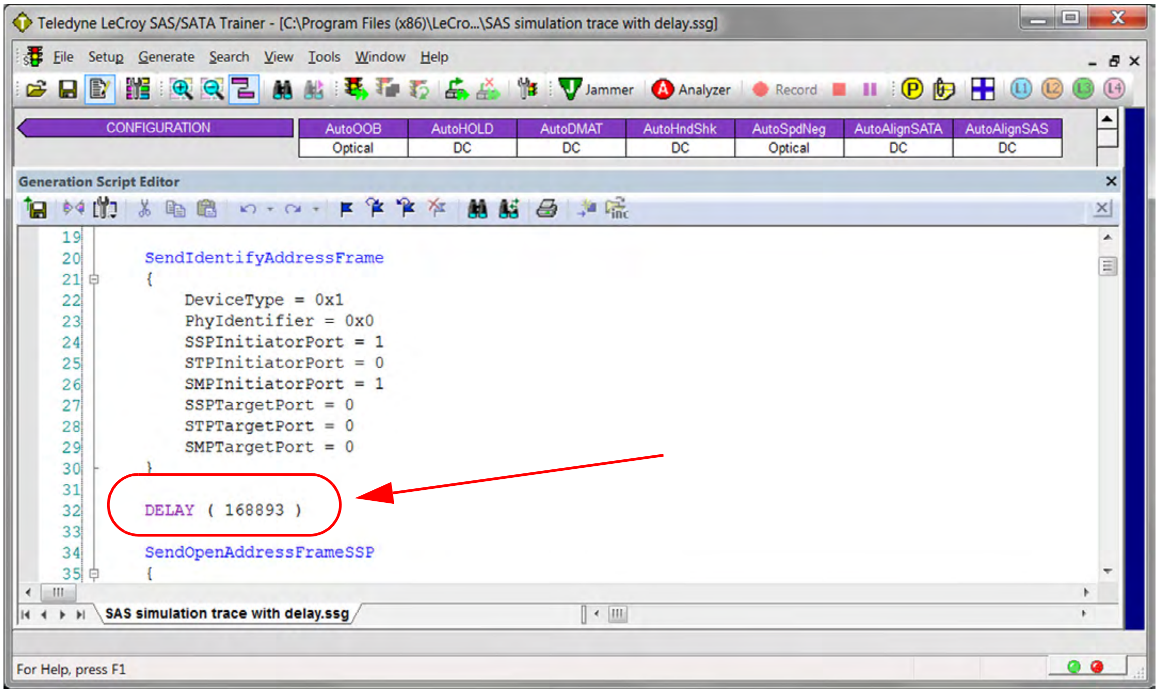
● All Trace
○ From X-Cursor To Y-Cursor
○ From ATA Cmd. No 1 To ATA Cmd. No 1
☑ SSP Frames ☑ SMP Frames ☑ STP Frames
☐ Insert Waits ☐ Auto Aligment ☑ Insert Delays
Port: I1
Project Type : ● SAS ○ SATA
Trainer Generation File: C:\Users\Public\Documents\LeCroy\SAS SATA Protoc

Figure 2.12: Export to Trainer Dialog

In the Export to Trainer dialog you can:

- Limit the range of the saved file. You can save:
  - All Traces
  - Range between selected cursors
  - Range between SCSI Commands, SMP Commands or Transport
- Import **SSP Frames, SMP Frames,** or **STP Frames** (see “Events and Event Properties” on page 435).
- **Insert Waits** inserts the appropriate **Wait_for** commands in the Trainer script as a function of the protocol state machine. An example would be to insert a **Wait_for open_accept** after an **open** command is exported. This allows the script to work, even if the DUT has different timing than the DUT in the original trace. See “Wait Commands” on page 409.

- ❑ **Insert Delays** inserts the exact delays as they appear in the original exported trace. This may result in the closest match in terms of timing to the original trace, but may not work with other DUTs. See Figure 2.13.


Teledyne LeCroy SAS/SATA Trainer - [C:\Program Files (x86)\LeCro...\SAS simulation trace with delay.ssg]
File Setup Generate Search View Tools Window Help
Jammer
Analyzer
Record
CONFIGURATION
AutoOOB Optical
AutoHOLD DC
AutoDMAT DC
AutoHndShk DC
AutoSpdNeg Optical
AutoAlignSATA DC
AutoAlignSAS DC
Generation Script Editor
SAS simulation trace with delay.ssg
For Help, press F1

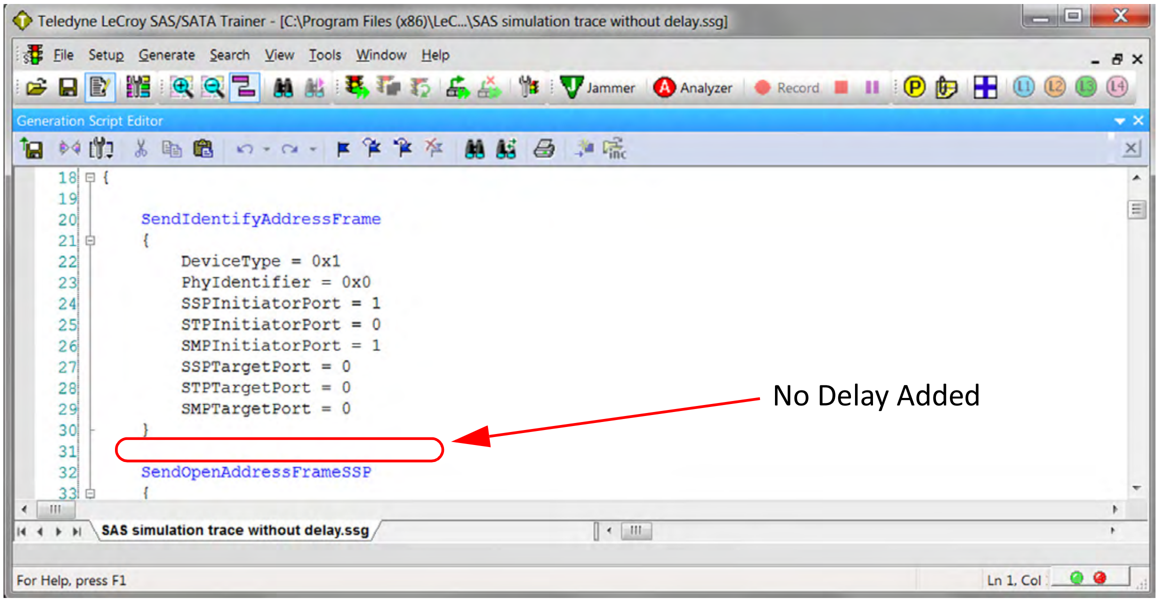
```
SendIdentifyAddressFrame
{
    DeviceType = 0x1
    PhyIdentifier = 0x0
    SSPInitiatorPort = 1
    STPInitiatorPort = 0
    SMPInitiatorPort = 1
    SSPTargetPort = 0
    STPTargetPort = 0
    SMPTargetPort = 0
}

DELAY ( 168893 )

SendOpenAddressFrameSSP
{
```

Figure 2.13: SAS Trainer Script with Delays

This option is selected by default but can be unselected by the user and no delays will be added to the Exported Trainer script. See Figure 2.14.


Teledyne LeCroy SAS/SATA Trainer - [C:\Program Files (x86)\LeC...\SAS simulation trace without delay.ssg]
File Setup Generate Search View Tools Window Help
Jammer
Analyzer
Record
Generation Script Editor
No Delay Added
SAS simulation trace without delay.ssg
For Help, press F1
Ln 1, Col

```
{

    SendIdentifyAddressFrame
    {
        DeviceType = 0x1
        PhyIdentifier = 0x0
        SSPInitiatorPort = 1
        STPInitiatorPort = 0
        SMPInitiatorPort = 1
        SSPTargetPort = 0
        STPTargetPort = 0
        SMPTargetPort = 0
    }

    SendOpenAddressFrameSSP
    {
```

Figure 2.14: Trainer Script with No Added Delay

- ❑ Use **Auto Alignment** (see “The Global Setting “AutoAlign”” on page 369).
- ❑ Select the **Port** (see “Setup Menu” on page 359).

- ☐ Indicate **Trainer Generation File Name** and click **Export** to export the trainer generation file.

Note: The resulting Trainer Generation file cannot exceed 2 MB or 1,000,000 packets.

Export Read/Write Command Report

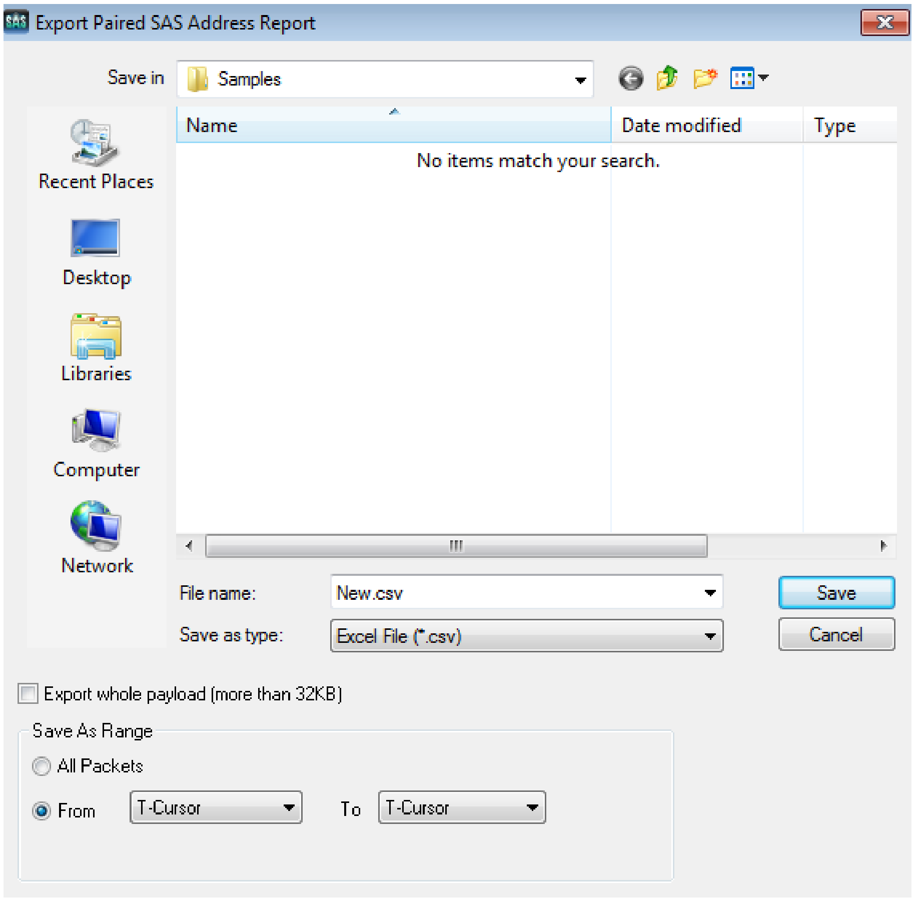
You can create an **Export Read/Write Command Report** as an Excel file (*.csv), using the **Export...** dialog from the File menu.

In **Setup > Preferences > Trace Viewer**, you must first select **Create statistical report read/write page** in order to create this report.

If this choice was not made when the trace was taken, then use **Save As** to save the trace file with this preference. This will append the **Read/Write Command Report** to the trace file, so this action need only be done once. When you re-open the trace file, you should be able to export the report as described above.

2.2.11 Export Paired SAS Address Report

If Text View is activated, from the File menu you can save a Paired SAS Address Report as an Excel file, using the Export Paired SAS Address Report dialog (see Figure 2.16 on page 62).


Export Paired SAS Address Report
Save in
Samples
Recent Places
Desktop
Libraries
Computer
Network
Name
Date modified
Type
Save
Cancel
All Packets

No items match your search.

File name: New.csv

Save as type: Excel File (*.csv)

☐ Export whole payload (more than 32KB)

Save As Range

○ All Packets

● From T-Cursor To T-Cursor

Figure 2.15: Export Paired SAS Address Report Dialog.

- Check the box **Export the whole payload (more than 32KB)** to export the whole payload (more than 32KB).
- You can limit the data range of the saved file. You can save:
  - All Packets
  - Range between selected cursors

You can view expanded traffic (particularly during discovery) in a spreadsheet format. You can use column headers with SAS Address Pairs. For example, instead of I1, T1, I2, T2, the columns are Source/Destination SAS Address pairs, such as S1:SEP or S2:EXP 0.

2.2.12 Trace Properties

Select **File > Trace Properties** to see the properties of the trace. For more information refer to “Trace Properties” on page 123.

2.2.13 Edit Comment

You can write comments and edit them for a trace for future use. Select **File > Edit Comment** to view the edit window. Key in the comments and close the window.

2.2.14 Projects

You can define a new project, starting with the default project definition, or modify the settings for the last project run.

New Default Project

To start a New project, select File > New on the main menu bar and choose Protocol Analyzer to open a new project with default settings that you can modify (see “Main Window” on page 45).

Last Project

Clicking the Green button ◉ opens the last project run, so you can modify it.

Project File Types

Projects have the following file types:

*.asl	Decoding script file (in the Examples folder “User Define Decoding Script” subfolder)
*.cfg	Display Configuration file (in the System folder “Config” subfolder)
*.dat	DataBlock file (in the System folder “DataBlock” subfolder)
*.sac	SAS Protocol Analyzer/Capture Project/Viewer file (in the Examples folder “EasyCaptr”, “AdvanceCaptr”, or “Exerciser” subfolders)
*.saf	Device Identifier file
*.scs	SAS Sample file (in the SAS Examples folder “Sample” subfolder)

*.sfl	Filter configuration file
*.spg	Single-role Pattern Generator file (in the Examples folder SAS “PatternGenerator\Single role (spg files)” subfolder and SATA “PatternGenerator\Single Role” subfolder). Single role means the file is for a Device or Host.
*.ssh	SAS Search configuration File
*.stc	SATA Protocol Analyzer/Capture Project/Viewer file (in the Examples folder “EasyCaptr”, “AdvanceCaptr”, or “Exerciser” subfolders)
*.sts	SATA Sample file (in the SATA Examples folder “Sample” subfolder)
*.tsh	SATA Search configuration file
*.wss	SAS Workspace file (in the SAS System folder “Predefined\Workspace” subfolder)
*.wst	SATA Workspace file (in the SATA System folder “PreDefined\Workspace” subfolder)

Example Projects

The Analyzer includes example projects that you can use to perform an immediate analysis without any setup.

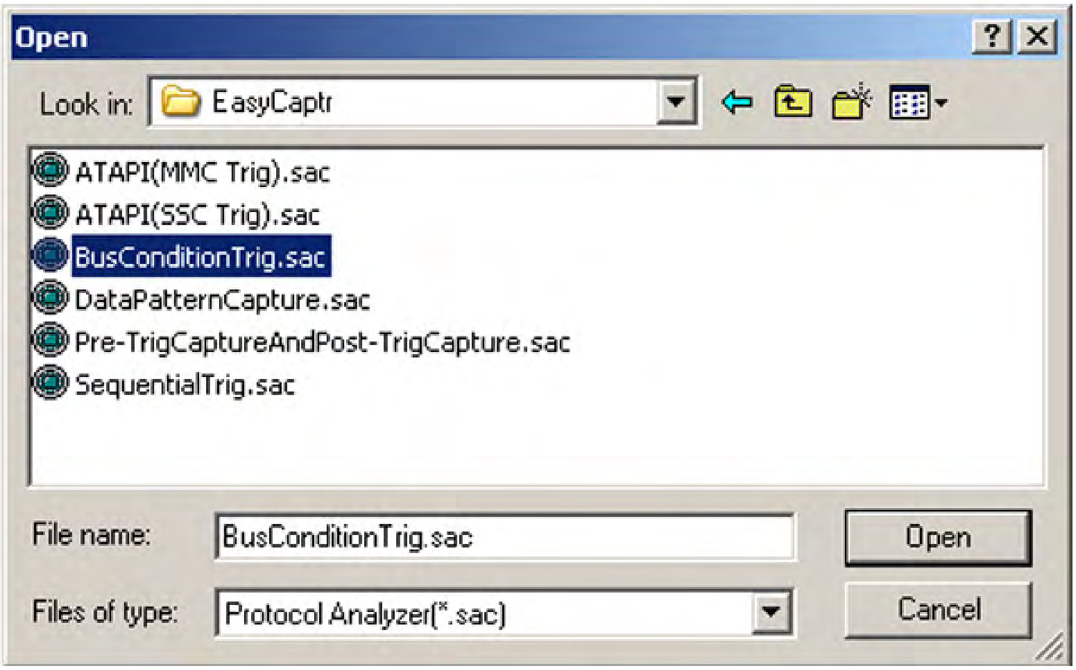
The Analyzer system software has a pre-defined folder (directory) structure for storing all files. All example files are in the Examples folder under the Sierra M122 folder.

It is strongly recommended that you open some example files to see types of projects that you can create.

Run an Example Analysis Project

To run an example project:

1. Select **File > Open.**
2. Locate example analysis projects by looking in the Examples folder. Examples are available for AdvanceCaptr, EasyCaptr, Exerciser, Samples, and User Define Decoding Script.
3. In the EasyCaptr folder, choose an example ***.sac** file and click **Open** to display the Open dialog (see Figure 2.16 on page 62).

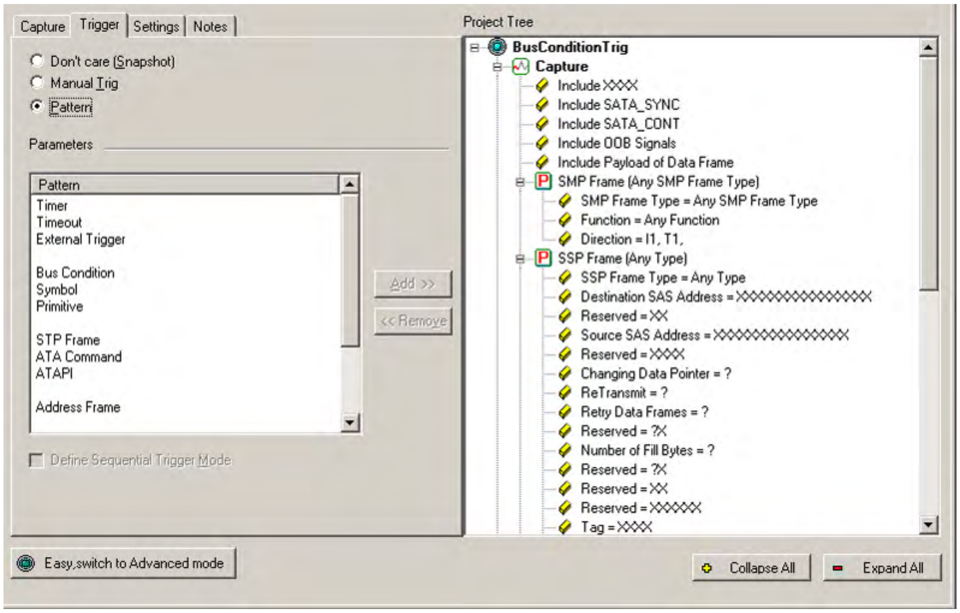

Open
?
Look in:
File name:
Files of type:
Open
Cancel

Look in: EasyCaptr

ATAPI(MMC Trig).sac
ATAPI(SSC Trig).sac
BusConditionTrig.sac
DataPatternCapture.sac
Pre-TrigCaptureAndPost-TrigCapture.sac
SequentialTrig.sac

File name: BusConditionTrig.sac
Files of type: Protocol Analyzer(*.sac)

Figure 2.16: File Open Dialog.

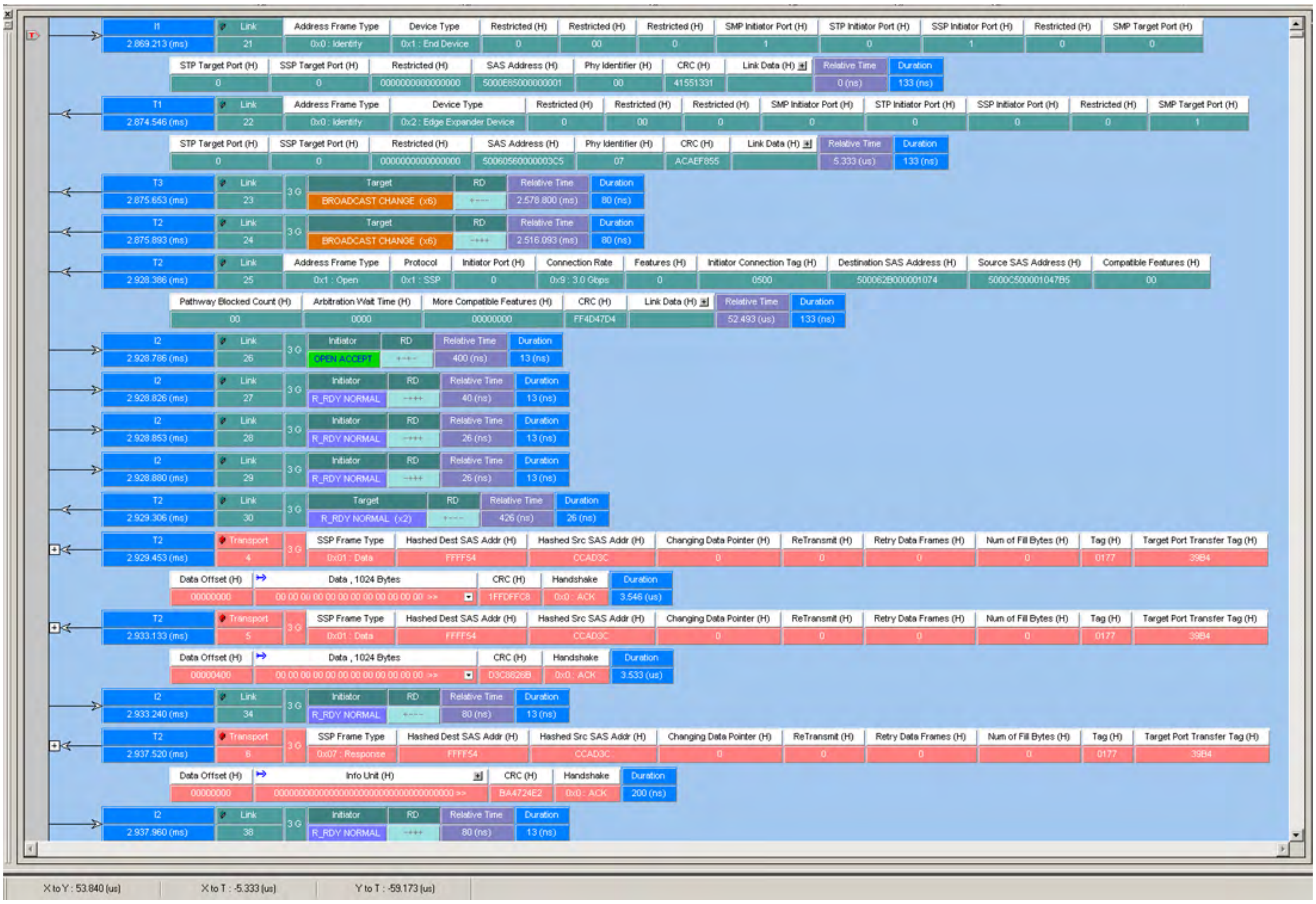

Capture
Trigger
Settings
Notes
○ Don't care (Snapshot)
○ Manual Trig
● Pattern
Parameters
Pattern
Timer
Timeout
External Trigger
Bus Condition
Symbol
Primitive
STP Frame
ATA Command
ATAPI
Address Frame
Add >>
<< Remove
☐ Define Sequential Trigger Mode
Easy,switch to Advanced mode
Project Tree
Collapse All
Expand All

BusConditionTrig
- Capture
  - Include XXXX
  - Include SATA_SYNC
  - Include SATA_CONT
  - Include OOB Signals
  - Include Payload of Data Frame
  - SMP Frame (Any SMP Frame Type)
    - SMP Frame Type = Any SMP Frame Type
    - Function = Any Function
    - Direction = I1, T1,
  - SSP Frame (Any Type)
    - SSP Frame Type = Any Type
    - Destination SAS Address = XXXXXXXXXXXXXXXX
    - Reserved = XX
    - Source SAS Address = XXXXXXXXXXXXXXXX
    - Reserved = XXXX
    - Changing Data Pointer = ?
    - ReTransmit = ?
    - Retry Data Frames = ?
    - Reserved = ?X
    - Number of Fill Bytes = ?
    - Reserved = ?X
    - Reserved = XX
    - Reserved = XXXXXX
    - Tag = XXXX

Figure 2.17: SAS: Sample Protocol Analysis Project

SAS vs. SATA: For Pattern Parameters, SATA Dialog adds FIS, FIS Pattern, and ATA Command Pattern and does not have STP Frame, SSP Frame, SMP Frame, and Address Frame.

4. Click the **Record** button to execute the pre-defined example.
5. After the project runs, you see an analyzer trace capture display similar to the one shown in Figure 2.18 on page 63.



I1	Link	Address Frame Type	Device Type	Restricted (H)	Restricted (H)	Restricted (H)	SMP Initiator Port (H)	STP Initiator Port (H)	SSP Initiator Port (H)	Restricted (H)	SMP Target Port (H)
2.869.213 (ms)	21	0x0 : Identify	0x1 : End Device	0	00	0	1	0	1	0	0

STP Target Port (H)	SSP Target Port (H)	Restricted (H)	SAS Address (H)	Phy Identifier (H)	CRC (H)	Link Data (H)	Relative Time	Duration
0	0	0000000000000000	5000E85000000001	00	41551331		0 (ns)	133 (ns)

T1	Link	Address Frame Type	Device Type	Restricted (H)	Restricted (H)	Restricted (H)	SMP Initiator Port (H)	STP Initiator Port (H)	SSP Initiator Port (H)	Restricted (H)	SMP Target Port (H)
2.874.546 (ms)	22	0x0 : Identify	0x2 : Edge Expander Device	0	00	0	0	0	0	0	1

STP Target Port (H)	SSP Target Port (H)	Restricted (H)	SAS Address (H)	Phy Identifier (H)	CRC (H)	Link Data (H)	Relative Time	Duration
0	0	0000000000000000	50060560000003C5	07	ACAEF855		5.333 (us)	133 (ns)

T3	Link		Target	RD	Relative Time	Duration
2.875.653 (ms)	23	3 G	BROADCAST CHANGE (x6)	+----	2.578.800 (ms)	80 (ns)

T2	Link		Target	RD	Relative Time	Duration
2.875.893 (ms)	24	3 G	BROADCAST CHANGE (x6)	-+++	2.516.093 (ms)	80 (ns)

T2	Link	Address Frame Type	Protocol	Initiator Port (H)	Connection Rate	Features (H)	Initiator Connection Tag (H)	Destination SAS Address (H)	Source SAS Address (H)	Compatible Features (H)
2.928.386 (ms)	25	0x1 : Open	0x1 : SSP	0	0x9 : 3.0 Gbps	0	0500	500062B000001074	5000C500001047B5	00

Pathway Blocked Count (H)	Arbitration Wait Time (H)	More Compatible Features (H)	CRC (H)	Link Data (H)	Relative Time	Duration
00	0000	00000000	FF4D47D4		52.493 (us)	133 (ns)

I2	Link		Initiator	RD	Relative Time	Duration
2.928.786 (ms)	26	3 G	OPEN ACCEPT	+-+--	400 (ns)	13 (ns)

I2	Link		Initiator	RD	Relative Time	Duration
2.928.826 (ms)	27	3 G	R_RDY NORMAL	-+++	40 (ns)	13 (ns)

I2	Link		Initiator	RD	Relative Time	Duration
2.928.853 (ms)	28	3 G	R_RDY NORMAL	-+++	26 (ns)	13 (ns)

I2	Link		Initiator	RD	Relative Time	Duration
2.928.880 (ms)	29	3 G	R_RDY NORMAL	-+++	26 (ns)	13 (ns)

T2	Link		Target	RD	Relative Time	Duration
2.929.306 (ms)	30	3 G	R_RDY NORMAL (x2)	+----	426 (ns)	26 (ns)

T2	Transport		SSP Frame Type	Hashed Dest SAS Addr (H)	Hashed Src SAS Addr (H)	Changing Data Pointer (H)	ReTransmit (H)	Retry Data Frames (H)	Num of Fill Bytes (H)	Tag (H)	Target Port Transfer Tag (H)
2.929.453 (ms)	4	3 G	0x01 : Data	FFFF54	CCAD3C	0	0	0	0	0177	39B4

Data Offset (H)	Data , 1024 Bytes	CRC (H)	Handshake	Duration
00000000	00 00 00 00 00 00 00 00 00 00 00 00 00 00 >>	1FFDFFC8	0x0 : ACK	3.546 (us)

T2	Transport		SSP Frame Type	Hashed Dest SAS Addr (H)	Hashed Src SAS Addr (H)	Changing Data Pointer (H)	ReTransmit (H)	Retry Data Frames (H)	Num of Fill Bytes (H)	Tag (H)	Target Port Transfer Tag (H)
2.933.133 (ms)	5	3 G	0x01 : Data	FFFF54	CCAD3C	0	0	0	0	0177	39B4

Data Offset (H)	Data , 1024 Bytes	CRC (H)	Handshake	Duration
00000400	00 00 00 00 00 00 00 00 00 00 00 00 00 00 >>	D3C8826B	0x0 : ACK	3.533 (us)

I2	Link		Initiator	RD	Relative Time	Duration
2.933.240 (ms)	34	3 G	R_RDY NORMAL	+----	80 (ns)	13 (ns)

T2	Transport		SSP Frame Type	Hashed Dest SAS Addr (H)	Hashed Src SAS Addr (H)	Changing Data Pointer (H)	ReTransmit (H)	Retry Data Frames (H)	Num of Fill Bytes (H)	Tag (H)	Target Port Transfer Tag (H)
2.937.520 (ms)	6	3 G	0x07 : Response	FFFF54	CCAD3C	0	0	0	0	0177	39B4

Data Offset (H)	Info Unit (H)	CRC (H)	Handshake	Duration
00000000	0000000000000000000000000000000000 >>	BA4724E2	0x0 : ACK	200 (ns)

I2	Link		Initiator	RD	Relative Time	Duration
2.937.960 (ms)	38	3 G	R_RDY NORMAL	-+++	80 (ns)	13 (ns)

X to Y : 53.840 (us) | X to T : -5.333 (us) | Y to T : -59.173 (us)

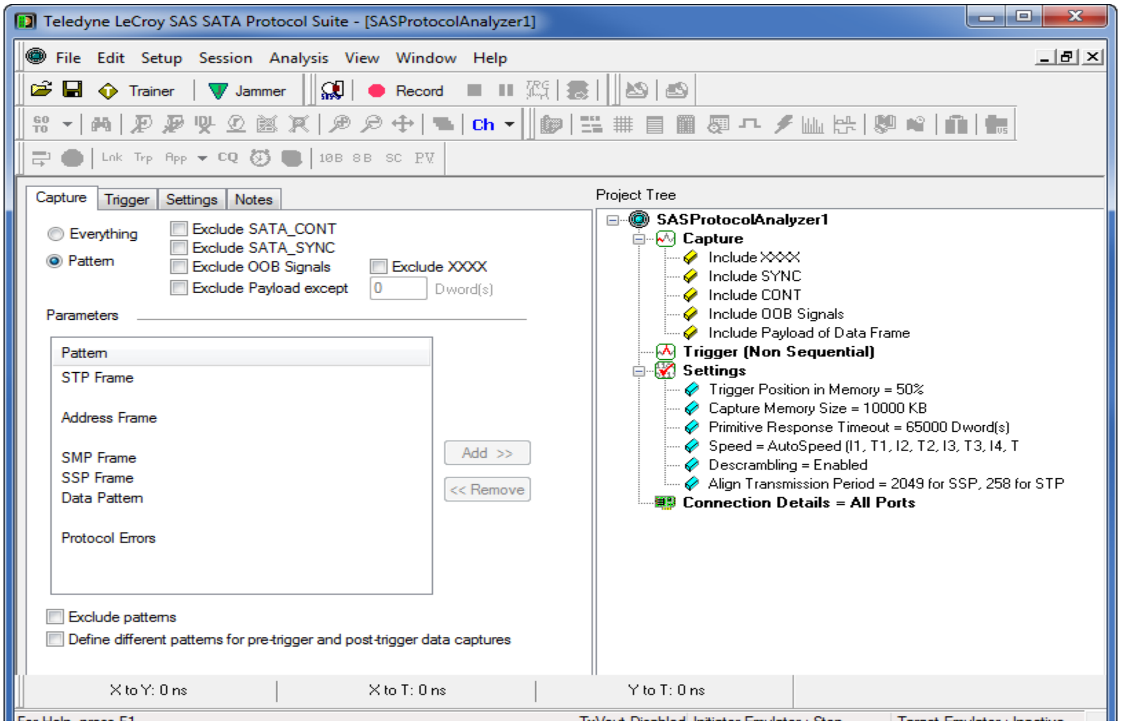
Figure 2.18: SAS: Analyzer Trace Capture Display

For details about the results display, see “Display Manipulation” on page 121 and “Display Configuration” on page 238.

Patterns and Data Capture Setup

You can refine data capture by choosing Pattern and then selecting specific patterns for capture. Additionally, you can define a different set of patterns to capture after trigger.

To define specific patterns for capture, click the **Pattern** button (see Figure 2.19 on page 64.)


Teledyne LeCroy SAS SATA Protocol Suite - [SASProtocolAnalyzer1]
File
Edit
Setup
Session
Analysis
View
Window
Help
Trainer
Jammer
Record
Ch
Lnk
Trp
App
CQ
10B
8B
SC
PV
Capture
Trigger
Settings
Notes
Add >>
<< Remove
X to Y: 0 ns
X to T: 0 ns
Y to T: 0 ns

○ Everything
● Pattern

☐ Exclude SATA_CONT
☐ Exclude SATA_SYNC
☐ Exclude OOB Signals
☐ Exclude XXXX
☐ Exclude Payload except 0 Dword(s)

Parameters

Pattern
STP Frame
Address Frame
SMP Frame
SSP Frame
Data Pattern
Protocol Errors

☐ Exclude patterns
☐ Define different patterns for pre-trigger and post-trigger data captures

Project Tree

- SASProtocolAnalyzer1
  - Capture
    - Include XXXX
    - Include SYNC
    - Include CONT
    - Include OOB Signals
    - Include Payload of Data Frame
  - Trigger (Non Sequential)
  - Settings
    - Trigger Position in Memory = 50%
    - Capture Memory Size = 10000 KB
    - Primitive Response Timeout = 65000 Dword(s)
    - Speed = AutoSpeed (I1, T1, I2, T2, I3, T3, I4, T
    - Descrambling = Enabled
    - Align Transmission Period = 2049 for SSP, 258 for STP
  - Connection Details = All Ports

Figure 2.19: SAS: Choosing Capture Patterns

SAS vs. SATA: SATA Dialog replaces “Exclude SATA_CONT” with “Exclude CONT” and “Exclude SATA_SYNC” with “Exclude SYNC”.

The SAS Parameters window displays the following pattern capture choice categories:

- STP Frame
- Address Frame
- SMP Frame
- SSP Frame
- Data Pattern
- Protocol Errors

The SATA Parameters window displays the following pattern capture choice categories:

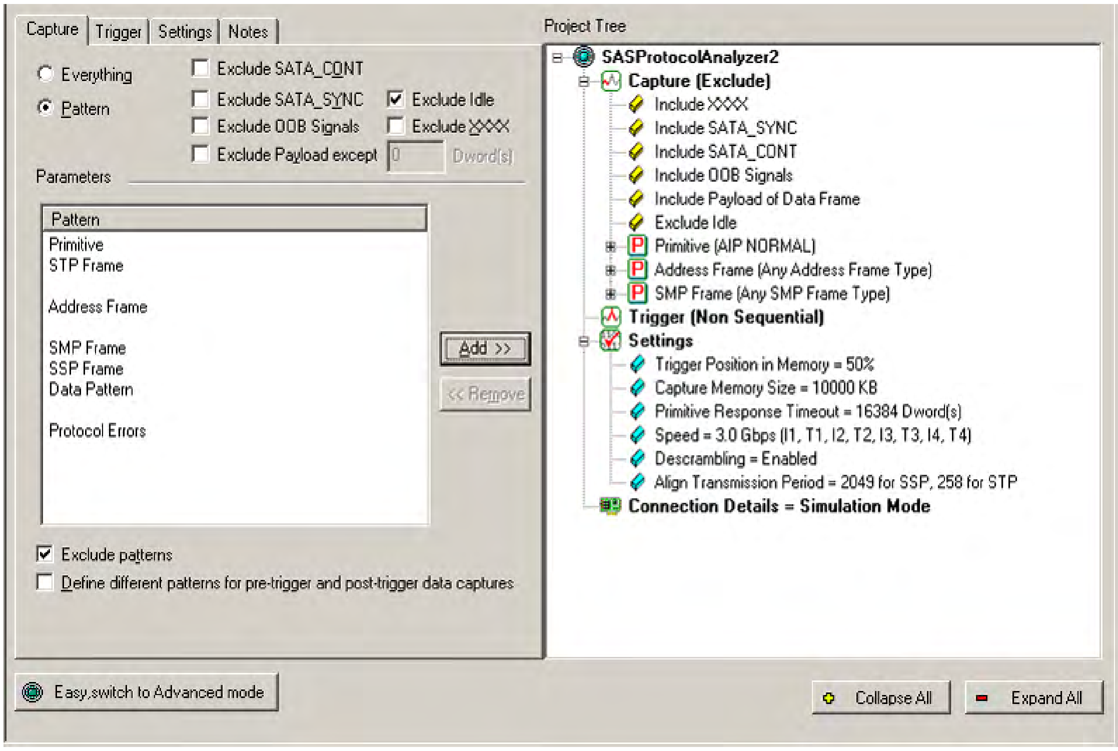
- FIS
- FIS Pattern
- Data Pattern
- Protocol Errors

Choose a Parameter

To choose a parameter for capture from any of these categories, highlight the category in the parameter window and click the **Add>>** button. This opens selection dialogs for each of the categories, displaying all parameters for that category. All of the patterns added appear in the project tree.

Exclude Patterns

Check this box to allow capture of everything **except** the patterns added to the Project Tree. When you check this box, the system adds the Primitive category to the parameter window and enables Exclude Idle.



○ Everything
● Pattern

☐ Exclude SATA_CONT
☐ Exclude SATA_SYNC ☑ Exclude Idle
☐ Exclude OOB Signals ☐ Exclude XXX
☐ Exclude Payload except 0 Dword(s)

Pattern
Primitive
STP Frame
Address Frame
SMP Frame
SSP Frame
Data Pattern
Protocol Errors

☑ Exclude patterns
☐ Define different patterns for pre-trigger and post-trigger data captures

Project Tree
- SASProtocolAnalyzer2
  - Capture (Exclude)
    - Include XXX
    - Include SATA_SYNC
    - Include SATA_CONT
    - Include OOB Signals
    - Include Payload of Data Frame
    - Exclude Idle
    - Primitive (AIP NORMAL)
    - Address Frame (Any Address Frame Type)
    - SMP Frame (Any SMP Frame Type)
  - Trigger (Non Sequential)
  - Settings
    - Trigger Position in Memory = 50%
    - Capture Memory Size = 10000 KB
    - Primitive Response Timeout = 16384 Dword(s)
    - Speed = 3.0 Gbps (I1, T1, I2, T2, I3, T3, I4, T4)
    - Descrambling = Enabled
    - Align Transmission Period = 2049 for SSP, 258 for STP
  - Connection Details = Simulation Mode

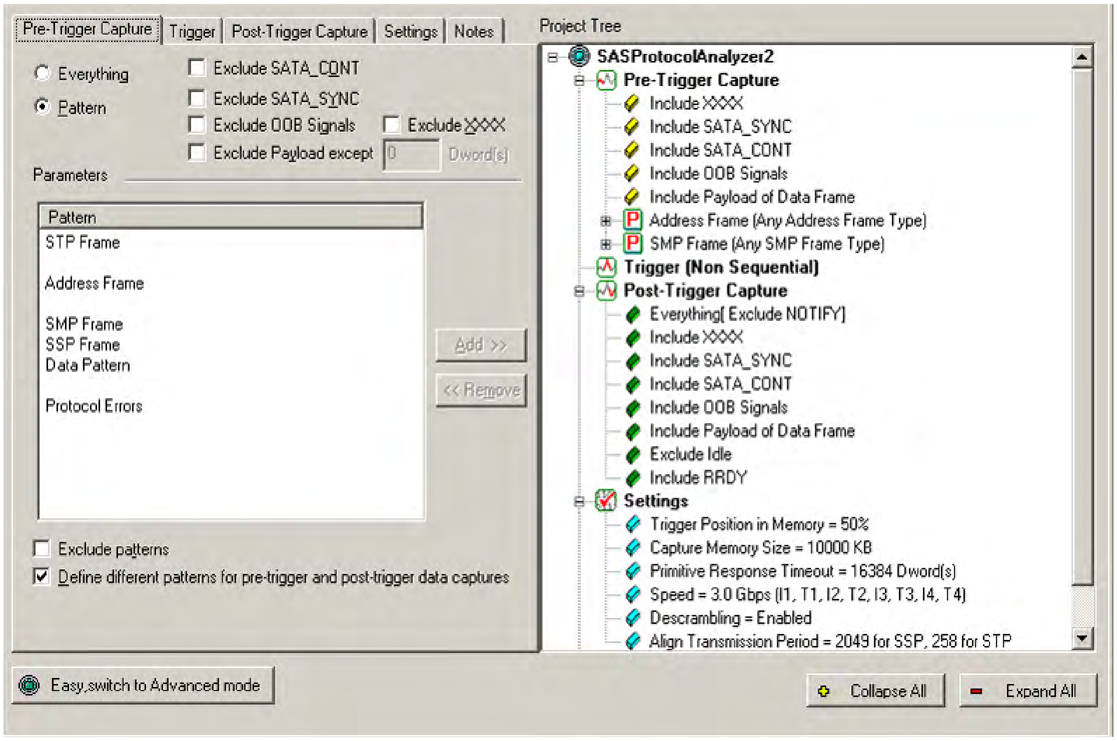
Figure 2.20: SAS: Exclude Patterns Checked

SAS vs. SATA: SATA Dialog replaces “Exclude SATA_CONT” with “Exclude CONT” and “Exclude SATA_SYNC” with “Exclude SYNC”. SATA Dialog has “ Exclude Dev Slp Packets”. SATA Dialog has different Pattern Parameters (see “Patterns and Data Capture Setup” on page 63.)

To remove an item from capture, highlight it in the Project Tree and click the **<<Remove** button.

Pre- and Post-Trigger Data Capture

You can define one set of patterns for capture prior to the occurrence of a trigger and another set of patterns for capture after the occurrence of a trigger. The selections and setup procedure is the same for both, the Pre-Trigger capture and the Post-Trigger capture. To define different patterns for pre-trigger and post-trigger data capture, check **Define different patterns for pre-trigger and post-trigger data capture** to enable the Post-Trigger Capture tab (see Figure 2.21 on page 66).


Pre-Trigger Capture
Trigger
Post-Trigger Capture
Settings
Notes
○ Everything
● Pattern
☐ Exclude SATA_CONT
☐ Exclude SATA_SYNC
☐ Exclude OOB Signals
☐ Exclude XXXX
☐ Exclude Payload except
0
Dword(s)
Parameters
Pattern
STP Frame
Address Frame
SMP Frame
SSP Frame
Data Pattern
Protocol Errors
Add >>
<< Remove
☐ Exclude patterns
☑ Define different patterns for pre-trigger and post-trigger data captures
Easy, switch to Advanced mode
Project Tree
Collapse All
Expand All

- SASProtocolAnalyzer2
  - Pre-Trigger Capture
    - Include XXXX
    - Include SATA_SYNC
    - Include SATA_CONT
    - Include OOB Signals
    - Include Payload of Data Frame
    - Address Frame (Any Address Frame Type)
    - SMP Frame (Any SMP Frame Type)
  - Trigger (Non Sequential)
  - Post-Trigger Capture
    - Everything(Exclude NOTIFY)
    - Include XXXX
    - Include SATA_SYNC
    - Include SATA_CONT
    - Include OOB Signals
    - Include Payload of Data Frame
    - Exclude Idle
    - Include RRDY
  - Settings
    - Trigger Position in Memory = 50%
    - Capture Memory Size = 10000 KB
    - Primitive Response Timeout = 16384 Dword(s)
    - Speed = 3.0 Gbps (I1, T1, I2, T2, I3, T3, I4, T4)
    - Descrambling = Enabled
    - Align Transmission Period = 2049 for SSP, 258 for STP

Figure 2.21: SAS: Post-trigger Capture Dialog Enabled

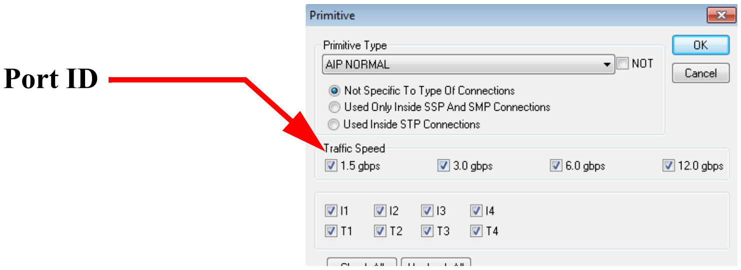
SAS vs. SATA: SATA Dialog replaces “Exclude SATA_CONT” with “Exclude CONT” and “Exclude SATA_SYNC” with “Exclude SYNC”. SATA Dialog has different Pattern Parameters (see “Patterns and Data Capture Setup” on page 63.)

Defining Patterns

To select an item for capture, either highlight the category and click the **Add>>** button or double-click the category to open a corresponding definition dialog. You can define patterns for specific ports by checking or unchecking Port ID.

Primitive

Double-click **Primitive** (available only if you check Exclude Patterns) to open the Primitive selection dialog.


Port ID
Primitive
Primitive Type
OK
Cancel

AIP NORMAL ☐ NOT

● Not Specific To Type Of Connections
○ Used Only Inside SSP And SMP Connections
○ Used Inside STP Connections

Traffic Speed
☑ 1.5 gbps ☑ 3.0 gbps ☑ 6.0 gbps ☑ 12.0 gbps

☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4

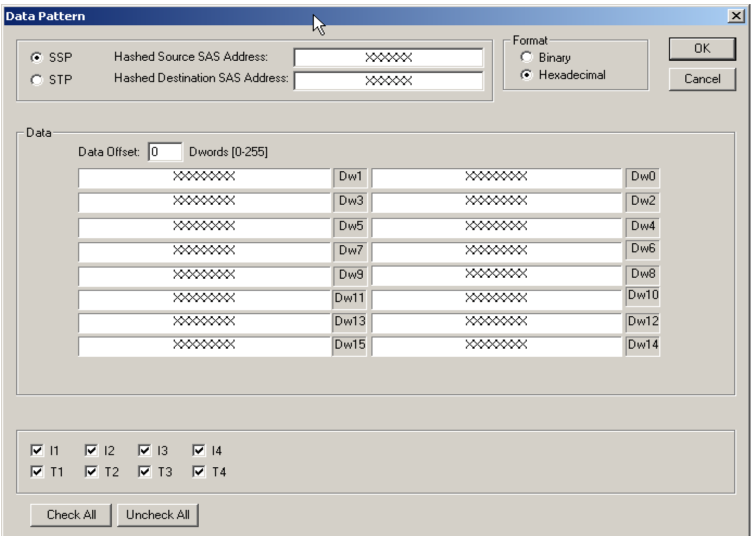
Figure 2.22: SAS: Primitive Dialog

SAS vs. SATA: SATA Dialog has no radio buttons and has different drop-down options.

Click the down arrow next to the Primitive drop-down list box, choose a Primitive to exclude, and click **OK.** Repeat for additional Primitives.

Data Pattern

Double-click **Data Pattern** to open the Data Pattern definition dialog.



Data Pattern

● SSP Hashed Source SAS Address: XXXXXX

○ STP Hashed Destination SAS Address: XXXXXX

Format
○ Binary
● Hexadecimal

Data

Data Offset: 0 Dwords [0-255]

XXXXXXXX	Dw1	XXXXXXXX	Dw0
XXXXXXXX	Dw3	XXXXXXXX	Dw2
XXXXXXXX	Dw5	XXXXXXXX	Dw4
XXXXXXXX	Dw7	XXXXXXXX	Dw6
XXXXXXXX	Dw9	XXXXXXXX	Dw8
XXXXXXXX	Dw11	XXXXXXXX	Dw10
XXXXXXXX	Dw13	XXXXXXXX	Dw12
XXXXXXXX	Dw15	XXXXXXXX	Dw14

☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4

Figure 2.23: SAS: Data Pattern Dialog

SAS vs. SATA: SATA Dialog shows Port at the top and does not show SSP or STP.

Define the data pattern for capture or exclusion from capture and click **OK**.

Note: When entering the data pattern in the “data” section of this screen, if you are reading the data pattern from a recorded trace, you must reverse the order of the bytes listed for each DWORD entered. For example, if you want to capture (or exclude) “00 01 02 03” (as displayed in the trace), you must enter this pattern as “03 02 01 00”.

Protocol Errors

Double-click **Protocol Errors** to open the Protocol Errors selection dialog.

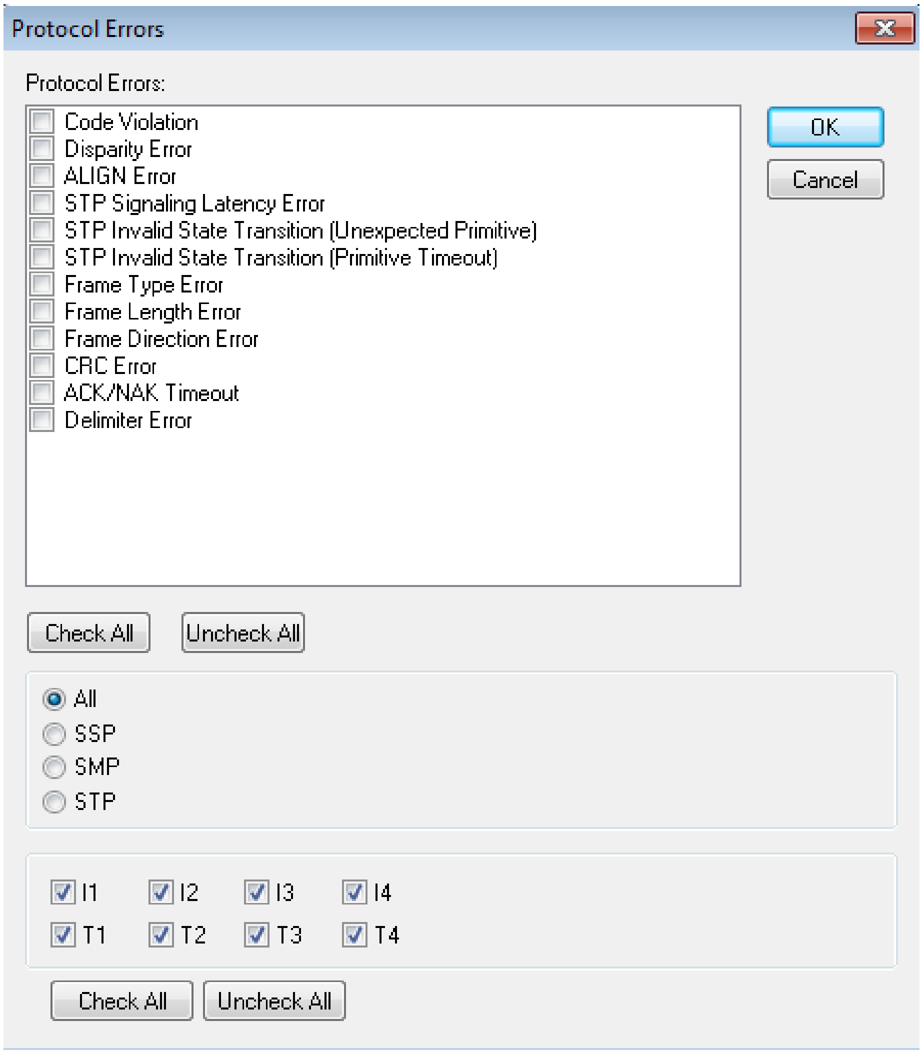

Protocol Errors
Protocol Errors:
☐ Code Violation
☐ Disparity Error
☐ ALIGN Error
☐ STP Signaling Latency Error
☐ STP Invalid State Transition (Unexpected Primitive)
☐ STP Invalid State Transition (Primitive Timeout)
☐ Frame Type Error
☐ Frame Length Error
☐ Frame Direction Error
☐ CRC Error
☐ ACK/NAK Timeout
☐ Delimiter Error
OK
Cancel
Check All
Uncheck All
● All
○ SSP
○ SMP
○ STP
☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4
Check All
Uncheck All

Figure 2.24: SAS: Protocol Errors Dialog

SAS vs. SATA: SATA dialog does not show ACK/NAK Timeout and has FIS signal-latency and state-transition errors, not STP ones. SATA dialog does not show ALL. SSP and SMP radio buttons.

Check protocol error(s) to omit or not capture, then click **OK**.

Protocol Errors

SMP Response Time Limit: is outside the specification requirements.

Code Violation: Wrong 10b symbol detected.

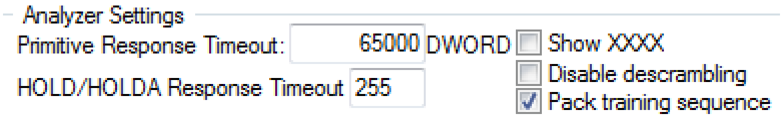
Disparity Error: Wrong disparity detected.

ALIGN Error: ALIGN primitive frequency is outside the specification requirements.

STP Signaling Latency Error [SAS only] or **FIS Signaling Latency Error [SATA only]**: DWORD difference between HOLD and HOLDA is greater than entered value in the HOLD/ HOLDA Response Timeout field.

STP Invalid State Transition (Unexpected Primitive) [SAS only] or **FIS Invalid State Transition (Unexpected Primitive) [SATA only]**: Second SATA_SOF is encountered before SATA_EOF, and other unexpected primitives.

STP Invalid State Transition (Primitive Timeout) [SAS only] or **FIS Invalid State Transition (Primitive Timeout) [SATA only]**: Timeout between two paired primitives is above entered value. 65000 DWORDs is default. For example, it can occur between WTRM and R_OK, or X_RDY and R_RDY. It expects device (or host) to send a response, but response is not received after 65000 DWORDs. You can configure Primitive Response Timeout and HOLD/HOLDA Response Timeout in the Settings tab Analyzer Settings section.



Analyzer Settings

Primitive Response Timeout: 65000 DWORD

HOLD/HOLDA Response Timeout 255

☐ Show XXXX

☐ Disable descrambling

☑ Pack training sequence

Frame Type Error: Wrong frame type.

Frame Length Error: Reported frame length is different than actual frame length.

Frame Direction Error: Wrong frame direction. For example, Register Device to Host coming from the Host.

CRC Error: CRC error detected.

ACK/NAK Timeout [SAS only]: ACK or NAK primitive missing or encountered unexpectedly.

Delimiter Error: Detects two SOF primitives without an EOF between them. Also detects two EOF primitives without an SOF between them.

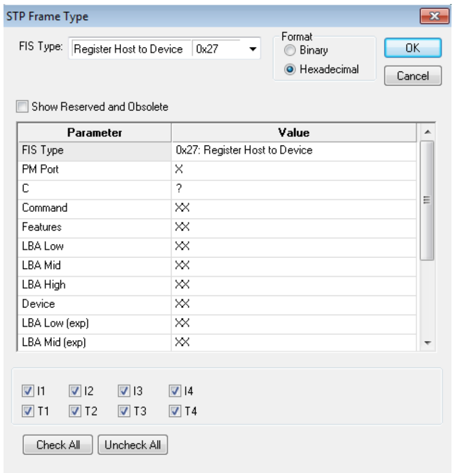
Radio Buttons: All, SSP, SMP and STP - By selecting one of these radio boxes you can specify that you want to trigger (or filter) on a specific protocol error on a specified frame type. If you check CRC error and select the SSP radio button, and if a CRC error occurs on a SMP frame, the analyzer does not trigger on it.

Hashed Destination SAS Address (SSP trigger only): Specify the destination address for the analyzer to locate specific protocol errors.

Hashed Source SAS Address (SSP trigger only): Specify the source address for the analyzer to locate specific protocol errors.

STP Frame

Double-click **STP Frame** to open the FIS Type dialog.



FIS Type: Register Host to Device 0x27

Format
○ Binary
● Hexadecimal

☐ Show Reserved and Obsolete

Parameter	Value
FIS Type	0x27: Register Host to Device
PM Port	X
C	?
Command	XX
Features	XX
LBA Low	XX
LBA Mid	XX
LBA High	XX
Device	XX
LBA Low (exp)	XX
LBA Mid (exp)	XX

☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4

Figure 2.25: FIS Pattern Dialog

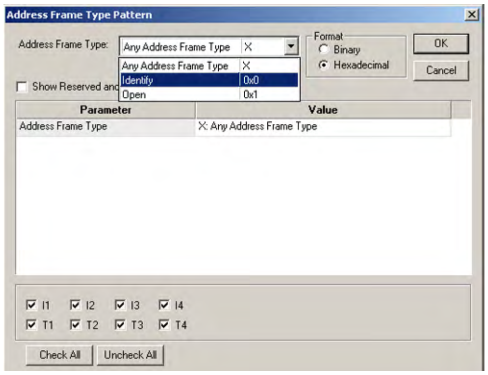
Click the down arrow next to the Type drop-down list box, choose an FIS type to capture or exclude, and click **OK**. Repeat for additional types.

Available FIS Types:

- Register Host to Device
- Register Device to Host
- Set Device Bits
- DMA Activate
- DMA Setup
- BIST
- PIO Setup
- Data
- Vendor

Address Frame (SAS only)

Double-click **Address Frame** to open the Address Frame Type Pattern dialog.


Address Frame Type Pattern
Address Frame Type:
Any Address Frame Type X
Any Address Frame Type X
Identify 0x0
Open 0x1
Show Reserved and
Format
Binary
Hexadecimal
OK
Cancel
I1 I2 I3 I4
T1 T2 T3 T4
Check All
Uncheck All

Parameter	Value
Address Frame Type	X: Any Address Frame Type

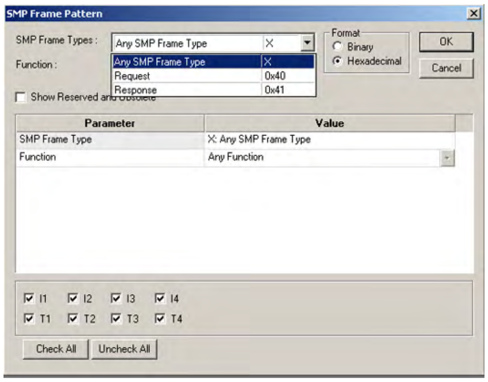
Figure 2.26: Address Frame Type Pattern Dialog

SAS vs. SATA: Not available in SATA.

Click the down arrow next to the Address Frame Types list box and choose an address frame type.

SMP Frame (SAS only)

Double-click **SMP Frame** to open the SMP Frame Pattern dialog.


SMP Frame Pattern
SMP Frame Types :
Any SMP Frame Type X
Function :
Any SMP Frame Type X
Request 0x40
Response 0x41
Show Reserved and Obsolete
Format
Binary
Hexadecimal
OK
Cancel
I1 I2 I3 I4
T1 T2 T3 T4
Check All
Uncheck All

Parameter	Value
SMP Frame Type	X: Any SMP Frame Type
Function	Any Function

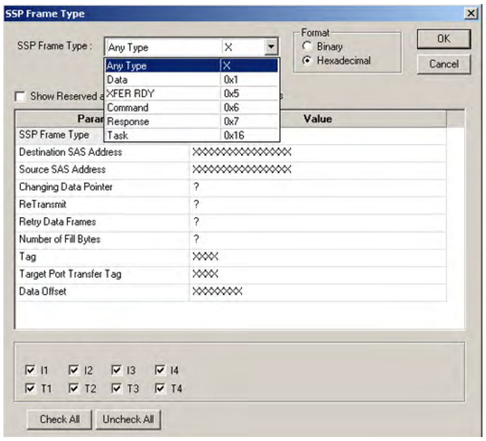
Figure 2.27: SMP Frame Pattern Dialog

SAS vs. SATA: Not available in SATA.

Click the down arrow next to the SMP Frame Type list box and choose a frame type. Assign a specific function to the frame by clicking the down arrow next to the Function list box and choose a function.

SSP Frame (SAS only)

Double-click **SSP Frame** to open the SSP Frame Pattern dialog.


SSP Frame Type
SSP Frame Type :
Format
○ Binary
● Hexadecimal
OK
Cancel
☐ Show Reserved a
☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4
Check All
Uncheck All

SSP Frame Type : Any Type X

Any Type	X
Data	0x1
XFER RDY	0x5
Command	0x6
Response	0x7
Task	0x16

Para	Value
SSP Frame Type	
Destination SAS Address	XXXXXXXXXXXXXXXX
Source SAS Address	XXXXXXXXXXXXXXXX
Changing Data Pointer	?
ReTransmit	?
Retry Data Frames	?
Number of Fill Bytes	?
Tag	XXXX
Target Port Transfer Tag	XXXX
Data Offset	XXXXXXXX

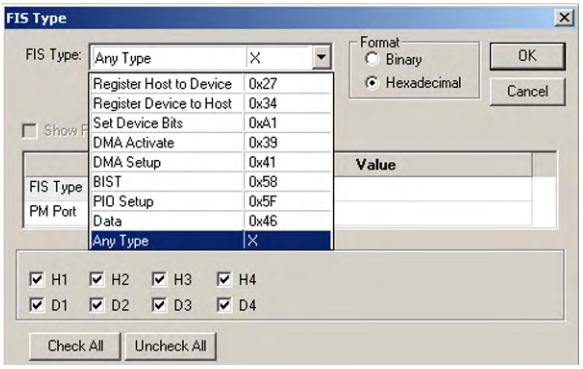
Figure 2.28: SSP Frame Type Dialog

SAS vs. SATA: Not available in SATA.

Click the down arrow next to the SSP Frame Type list box and choose an SSP Frame type.

FIS (SATA only)

Double-click **FIS (Frame Information Structure)** to open the FIS Type selection dialog.


FIS Type
FIS Type:
Format
○ Binary
● Hexadecimal
OK
Cancel
☐ Show F
Value
FIS Type
PM Port
☑ H1 ☑ H2 ☑ H3 ☑ H4
☑ D1 ☑ D2 ☑ D3 ☑ D4
Check All
Uncheck All

FIS Type: Any Type X

Register Host to Device	0x27
Register Device to Host	0x34
Set Device Bits	0xA1
DMA Activate	0x39
DMA Setup	0x41
BIST	0x58
PIO Setup	0x5F
Data	0x46
Any Type	X

SAS vs. SATA: Not available in SAS.

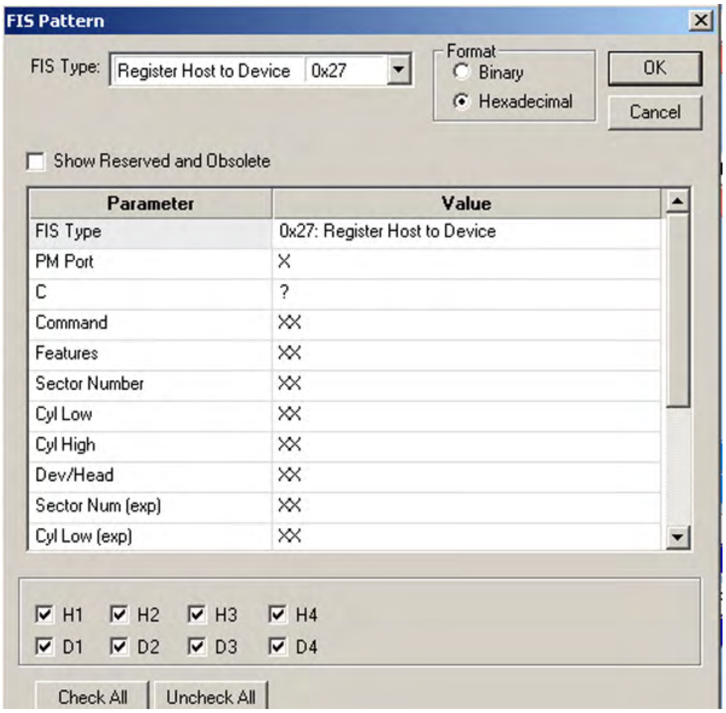
Click the down arrow next to the Type drop-down list box, choose a FIS type to capture, and click **OK**. Repeat for additional types.

Available FIS Types:

- Register Host to Device
- Register Device to Host
- Set Device Bit
- DMA Activate
- DMA Setup
- BIST
- PIO Setup
- Data
- Any Type

2.2.15 STP Frame Pattern

Double-click STP Pattern to open the STP Pattern selection dialog.



FIS Type: Register Host to Device 0x27

Format
○ Binary
● Hexadecimal

☐ Show Reserved and Obsolete

Parameter	Value
FIS Type	0x27: Register Host to Device
PM Port	X
C	?
Command	XX
Features	XX
Sector Number	XX
Cyl Low	XX
Cyl High	XX
Dev/Head	XX
Sector Num (exp)	XX
Cyl Low (exp)	XX

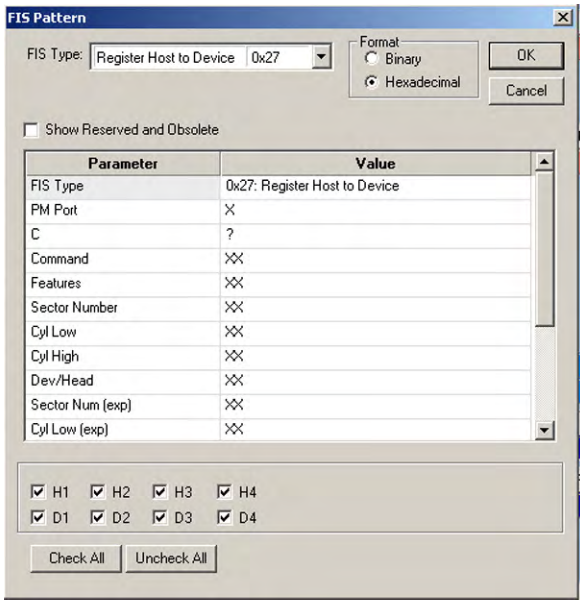
☑ H1 ☑ H2 ☑ H3 ☑ H4
☑ D1 ☑ D2 ☑ D3 ☑ D4

Figure 2.29: SATA: STP Pattern Dialog

The STP Pattern dialog opens with the default FIS Type as **Register Host to device.** To choose another available FIS Type, click the down arrow next to the FIS Type list box.

Choose FIS Type and complete the corresponding dialog.

Register Host to Device



FIS Type: Register Host to Device 0x27

Format: ○ Binary ● Hexadecimal

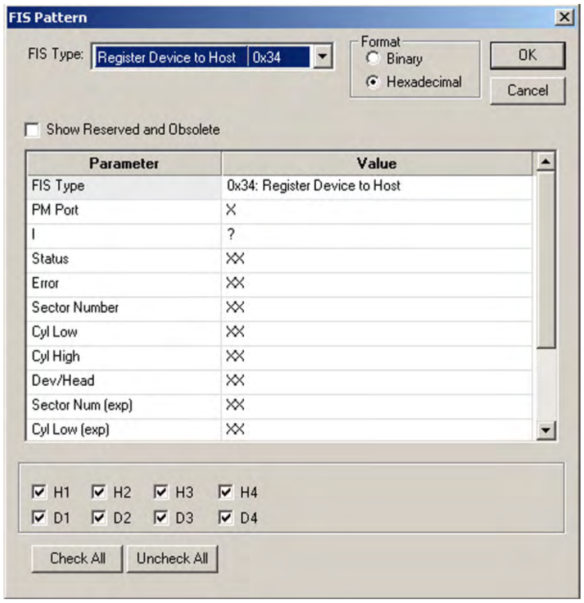
☐ Show Reserved and Obsolete

Parameter	Value
FIS Type	0x27: Register Host to Device
PM Port	X
C	?
Command	XX
Features	XX
Sector Number	XX
Cyl Low	XX
Cyl High	XX
Dev/Head	XX
Sector Num (exp)	XX
Cyl Low (exp)	XX

☑ H1 ☑ H2 ☑ H3 ☑ H4
☑ D1 ☑ D2 ☑ D3 ☑ D4

Figure 2.30: FIS Pattern - Register Host to Device Dialog

Register Device to Host



FIS Type: Register Device to Host 0x34

Format: ○ Binary ● Hexadecimal

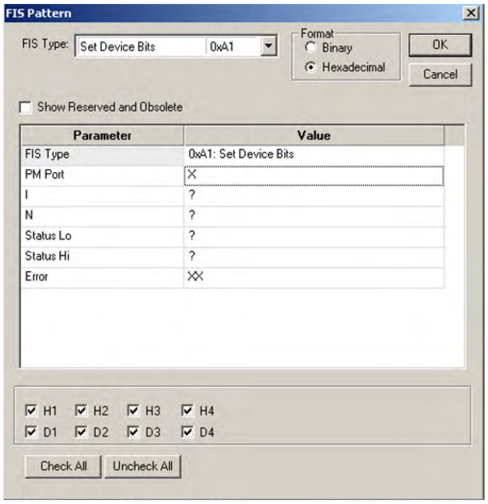
☐ Show Reserved and Obsolete

Parameter	Value
FIS Type	0x34: Register Device to Host
PM Port	X
I	?
Status	XX
Error	XX
Sector Number	XX
Cyl Low	XX
Cyl High	XX
Dev/Head	XX
Sector Num (exp)	XX
Cyl Low (exp)	XX

☑ H1 ☑ H2 ☑ H3 ☑ H4
☑ D1 ☑ D2 ☑ D3 ☑ D4

Figure 2.31: FIS Pattern - Register Device to Host Dialog

Set Device Bits


FIS Pattern
OK
Cancel
Check All
Uncheck All

FIS Type: Set Device Bits 0xA1

Format: ○ Binary ● Hexadecimal

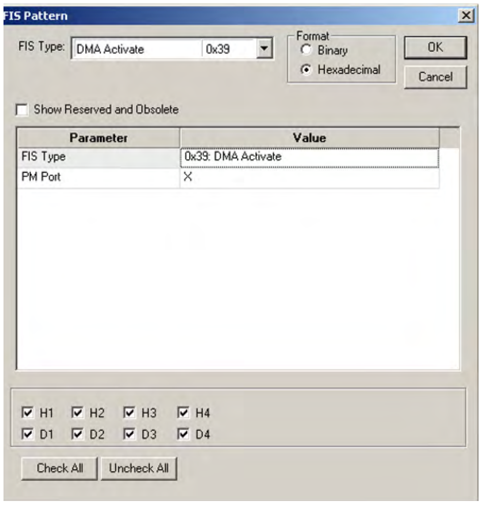
☐ Show Reserved and Obsolete

Parameter	Value
FIS Type	0xA1: Set Device Bits
PM Port	X
I	?
N	?
Status Lo	?
Status Hi	?
Error	XX

☑ H1 ☑ H2 ☑ H3 ☑ H4
☑ D1 ☑ D2 ☑ D3 ☑ D4

Figure 2.32: FIS Pattern - Set Device Bits Dialog

DMA Activate


FIS Pattern
OK
Cancel
Check All
Uncheck All

FIS Type: DMA Activate 0x39

Format: ○ Binary ● Hexadecimal

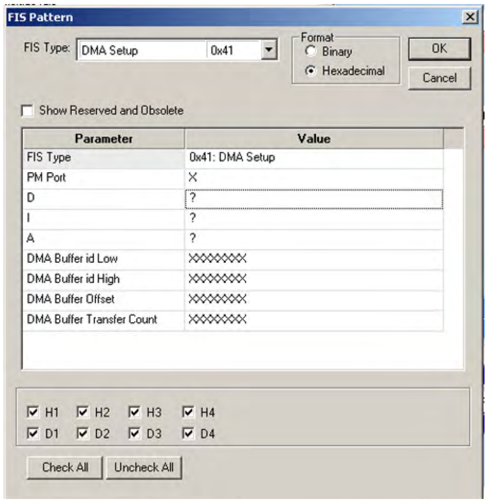
☐ Show Reserved and Obsolete

Parameter	Value
FIS Type	0x39: DMA Activate
PM Port	X

☑ H1 ☑ H2 ☑ H3 ☑ H4
☑ D1 ☑ D2 ☑ D3 ☑ D4

Figure 2.33: FIS Pattern - DMA Activate Dialog

DMA Setup


FIS Pattern
OK
Cancel
Check All
Uncheck All

FIS Type: DMA Setup 0x41

Format: ○ Binary ● Hexadecimal

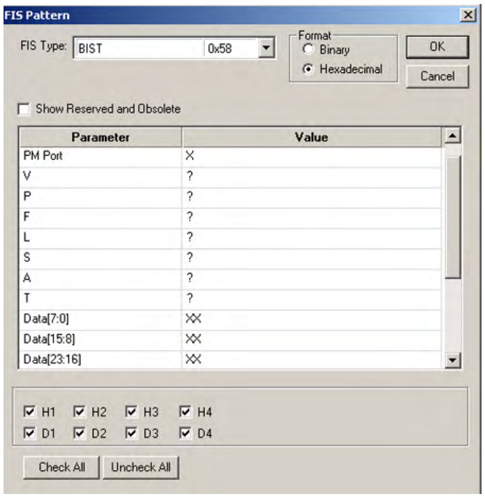
☐ Show Reserved and Obsolete

Parameter	Value
FIS Type	0x41: DMA Setup
PM Port	X
D	?
I	?
A	?
DMA Buffer id Low	XXXXXXXX
DMA Buffer id High	XXXXXXXX
DMA Buffer Offset	XXXXXXXX
DMA Buffer Transfer Count	XXXXXXXX

☑ H1 ☑ H2 ☑ H3 ☑ H4
☑ D1 ☑ D2 ☑ D3 ☑ D4

Figure 2.34: FIS Pattern - DMA Setup Dialog

BIST


FIS Pattern
OK
Cancel
Check All
Uncheck All

FIS Type: BIST 0x58

Format: ○ Binary ● Hexadecimal

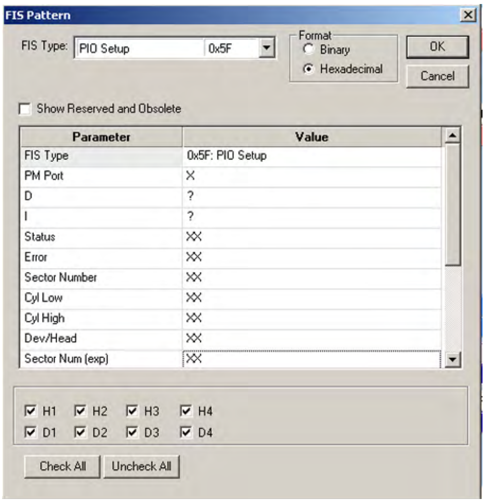
☐ Show Reserved and Obsolete

Parameter	Value
PM Port	X
V	?
P	?
F	?
L	?
S	?
A	?
T	?
Data[7:0]	XX
Data[15:8]	XX
Data[23:16]	XX

☑ H1 ☑ H2 ☑ H3 ☑ H4
☑ D1 ☑ D2 ☑ D3 ☑ D4

Figure 2.35: FIS Pattern - BIST Dialog

PIO Setup


FIS Pattern
OK
Cancel
Check All
Uncheck All

FIS Type: PIO Setup 0x5F

Format: ○ Binary ● Hexadecimal

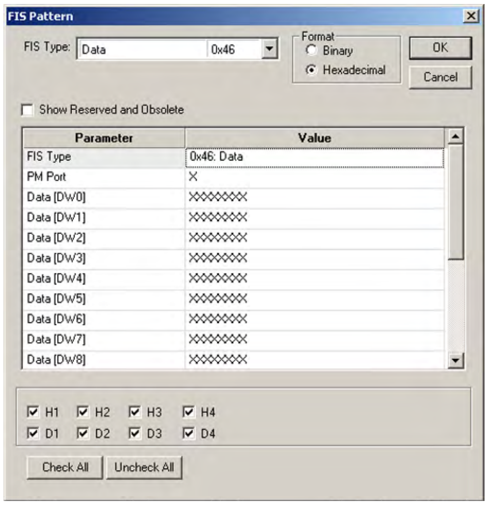
☐ Show Reserved and Obsolete

Parameter	Value
FIS Type	0x5F: PIO Setup
PM Port	X
D	?
I	?
Status	XX
Error	XX
Sector Number	XX
Cyl Low	XX
Cyl High	XX
Dev/Head	XX
Sector Num (exp)	XX

☑ H1 ☑ H2 ☑ H3 ☑ H4
☑ D1 ☑ D2 ☑ D3 ☑ D4

Figure 2.36: FIS Pattern - PIO Setup Dialog

Data


FIS Pattern
OK
Cancel
Check All
Uncheck All

FIS Type: Data 0x46

Format: ○ Binary ● Hexadecimal

☐ Show Reserved and Obsolete

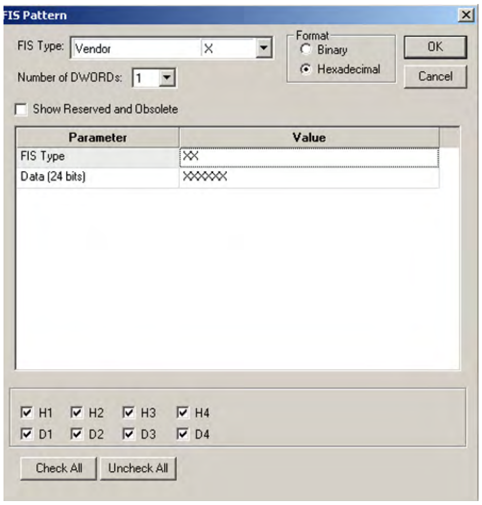
Parameter	Value
FIS Type	0x46: Data
PM Port	X
Data [DW0]	XXXXXXXX
Data [DW1]	XXXXXXXX
Data [DW2]	XXXXXXXX
Data [DW3]	XXXXXXXX
Data [DW4]	XXXXXXXX
Data [DW5]	XXXXXXXX
Data [DW6]	XXXXXXXX
Data [DW7]	XXXXXXXX
Data [DW8]	XXXXXXXX

☑ H1 ☑ H2 ☑ H3 ☑ H4
☑ D1 ☑ D2 ☑ D3 ☑ D4

Figure 2.37: FIS Pattern - Data Dialog

Vendor

Vendor is for FIS Pattern.



FIS Type: Vendor X

Number of DWORDs: 1

Format: ○ Binary ● Hexadecimal

☐ Show Reserved and Obsolete

Parameter	Value
FIS Type	XX
Data (24 bits)	XXXXXX

☑ H1 ☑ H2 ☑ H3 ☑ H4
☑ D1 ☑ D2 ☑ D3 ☑ D4

Figure 2.38: FIS Pattern - Vendor Dialog

2.2.16 Trigger Setup

The **Trigger** tab in the analysis project dialog allows you to specify when the analyzer completes a data capture. Three trigger modes are available:

- Don't care (Snapshot) is the default
- Manual Trig
- Pattern

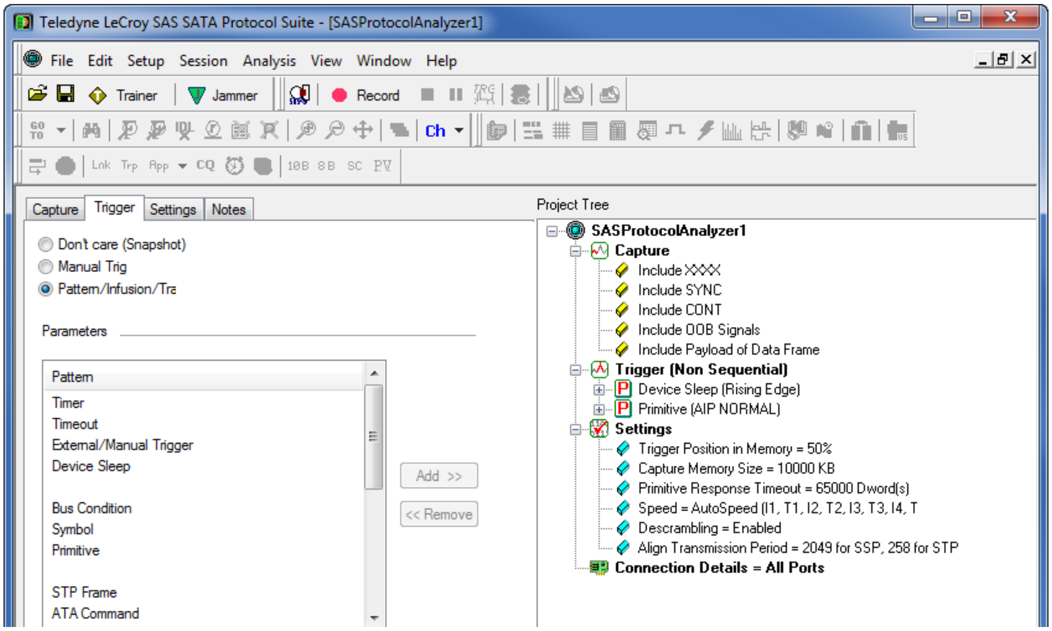
When data capture starts with **Don't care (Snapshot)** selected, the analyzer triggers on the first data pattern on the bus.

Starting a data capture with **Pattern** selected triggers when specific pattern(s) are detected in the captured data stream. The following three ways can trigger the analyzer with **Pattern** selected.

- Trigger on any pattern (Any Trigger Mode)
- External Trigger
- Trigger on a sequence of patterns (Sequential Trigger Mode)

Snapshot Mode

To trigger immediately on any pattern, check the **Don't care (Snapshot)** button.


Teledyne LeCroy SAS SATA Protocol Suite - [SASProtocolAnalyzer1]
File Edit Setup Session Analysis View Window Help
Trainer
Jammer
Record
Ch
Lnk Trp App CQ
10B 8B SC PV
Capture
Trigger
Settings
Notes
Parameters
Pattern
Timer
Timeout
External/Manual Trigger
Device Sleep
Bus Condition
Symbol
Primitive
STP Frame
ATA Command
Add >>
<< Remove
Project Tree

○ Don't care (Snapshot)
○ Manual Trig
● Pattern/Infusion/Tra

SASProtocolAnalyzer1
- Capture
  - Include XXXX
  - Include SYNC
  - Include CONT
  - Include OOB Signals
  - Include Payload of Data Frame
- Trigger (Non Sequential)
  - Device Sleep (Rising Edge)
  - Primitive (AIP NORMAL)
- Settings
  - Trigger Position in Memory = 50%
  - Capture Memory Size = 10000 KB
  - Primitive Response Timeout = 65000 Dword(s)
  - Speed = AutoSpeed (I1, T1, I2, T2, I3, T3, I4, T
  - Descrambling = Enabled
  - Align Transmission Period = 2049 for SSP, 258 for STP
- Connection Details = All Ports

Figure 2.39: Default Trigger Selected

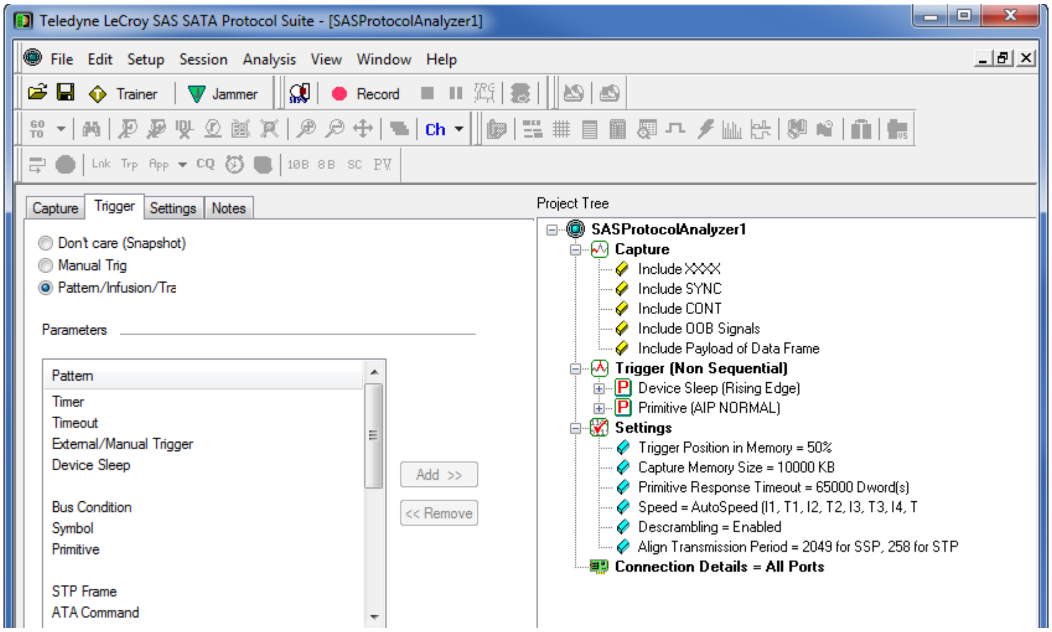
Manual Trigger Mode

To perform a manual trigger, check the **Manual Trig** radio button. In the **Manual Trigger** mode, the analyzer captures bus traffic continually from when you use the Manual Trigger until you click the **Stop Recording** button (on the analyzer toolbar), which triggers the analyzer. Clicking the **Manual Trigger** button on the application toolbar creates a Trigger Event and uploads the trace with the specified trigger position.

Any Trigger in Pattern Mode

In **Pattern** mode, the Analyzer triggers whenever any of the patterns selected for triggering occurs (an OR condition). The procedure for selecting trigger parameters is identical to that for selecting capture parameters. All items selected for triggering appear in the Project Tree.

To define patterns for triggering, check the **Pattern** button in the Trigger dialog (see Figure 2.40 on page 80.)


Teledyne LeCroy SAS SATA Protocol Suite - [SASProtocolAnalyzer1]
File Edit Setup Session Analysis View Window Help
Trainer
Jammer
Record
Ch
Lnk Trp App CQ
10B 8B SC PV
Capture
Trigger
Settings
Notes
Add >>
<< Remove
Project Tree

○ Don't care (Snapshot)
○ Manual Trig
● Pattern/Infusion/Tra

Parameters

Pattern
Timer
Timeout
External/Manual Trigger
Device Sleep

Bus Condition
Symbol
Primitive

STP Frame
ATA Command

SASProtocolAnalyzer1
- Capture
  - Include XXXX
  - Include SYNC
  - Include CONT
  - Include OOB Signals
  - Include Payload of Data Frame
- Trigger (Non Sequential)
  - Device Sleep (Rising Edge)
  - Primitive (AIP NORMAL)
- Settings
  - Trigger Position in Memory = 50%
  - Capture Memory Size = 10000 KB
  - Primitive Response Timeout = 65000 Dword(s)
  - Speed = AutoSpeed (I1, T1, I2, T2, I3, T3, I4, T
  - Descrambling = Enabled
  - Align Transmission Period = 2049 for SSP, 258 for STP
- Connection Details = All Ports

Figure 2.40: SAS: Select Patterns for Trigger

The SAS **Parameters** window displays the following trigger pattern categories:

- Timer
- Timeout
- External/Manual Trigger
- Device Sleep
- Bus Condition
- Symbol
- Primitive
- STP Frame
- ATA Command
- ATAPI
- Address Frame
- SMP Frame
- SSP Frame
- SCSI Command
- Data Pattern
- Protocol Errors

The SATA **Parameters** window displays the following trigger pattern categories:

- ☐ Timer
- ☐ Timeout
- ☐ External/Manual Trigger
- ☐ Device Sleep
- ☐ Bus Condition
- ☐ Symbol
- ☐ Primitive
- ☐ FIS
- ☐ STP Frame
- ☐ ATA Command
- ☐ ATA Command Pattern
- ☐ ATAPI
- ☐ Soft Reset
- ☐ Data Pattern
- ☐ Protocol Errors

Note: In packet view, you can right-click on any frame, select **Add to Trigger**, and add the pattern to **DataPatternCapture** to make it a trigger pattern.

Choosing a Parameter

Either highlight the category and click the Add>> button, or double-click the category, to open a corresponding definition dialog.

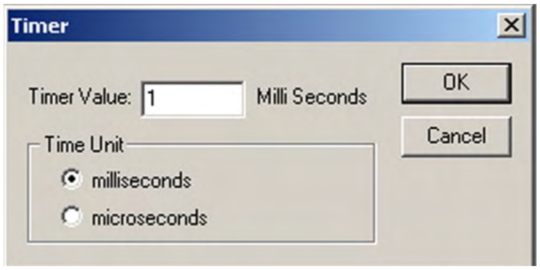
To remove an item, highlight it in the Project Tree, then click the **<<Remove** button.

Triggering on a Timer

Selecting a timer for a trigger in the **Any Trigger Mode** limits the time that the analyzer looks for selected triggering conditions before triggering. The timer activates when the Project runs. If none of the selected triggering conditions occurs during the timer's active time, the Analyzer triggers at the end of the time set for the timer.

You can set a timer independently of any other trigger selection, to cause an unconditional trigger after a set time.

To set the timer value, double-click **Timer** in the Pattern window to open the Timer dialog.



Timer Value: 1 Milli Seconds

Time Unit

● milliseconds

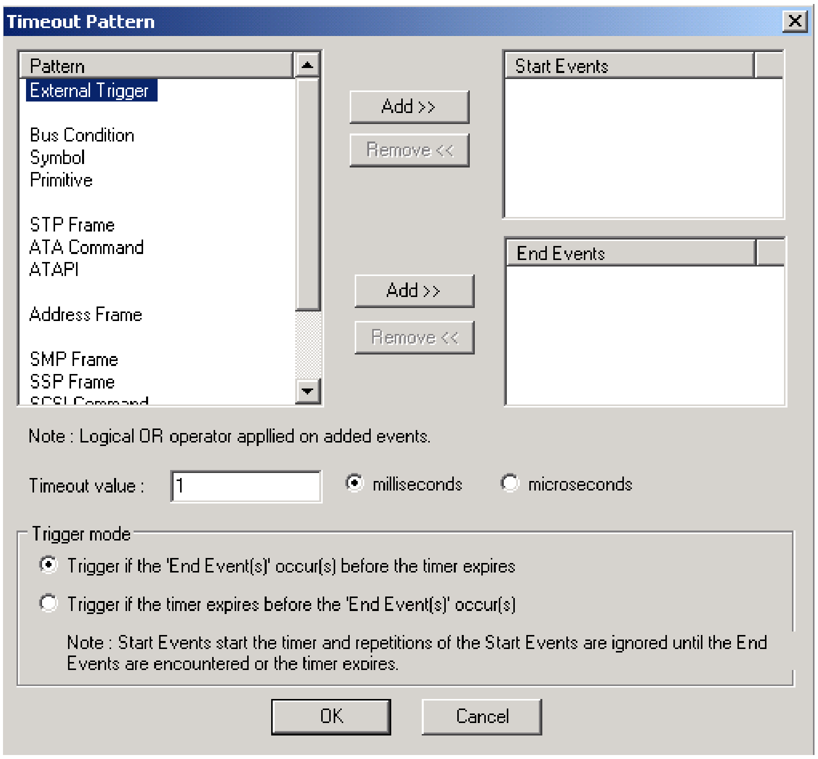
○ microseconds

Figure 2.41: Timer Dialog

Check a Time Unit, enter the Timer Value, and click OK.

Timeout

Selecting **Timeout** for the pattern opens the Timeout Pattern dialog.


Timeout Pattern
Pattern
External Trigger
Bus Condition
Symbol
Primitive
STP Frame
ATA Command
ATAPI
Address Frame
SMP Frame
SSP Frame
SCSI Command
Add >>
Remove <<
Start Events
Add >>
Remove <<
End Events
Trigger mode
OK
Cancel

Note : Logical OR operator appllied on added events.

Timeout value : 1 ● milliseconds ○ microseconds

Trigger mode

● Trigger if the 'End Event(s)' occur(s) before the timer expires

○ Trigger if the timer expires before the 'End Event(s)' occur(s)

Note : Start Events start the timer and repetitions of the Start Events are ignored until the End Events are encountered or the timer expires.

Figure 2.42: Timeout Dialog

"Start Events" starts the timer in Timeout Trigger and "End Events" triggers the analyzer (if first trigger mode is selected) or resets the trigger (if second trigger mode is selected). Repetitions of the Start Events are ignored until the End Event is encountered or the timer expires.

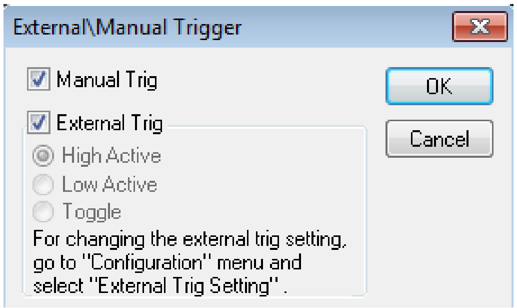
Select a pattern for Start Events or End Events, enter a Timeout value, then select Trigger Mode:

- If End Events occur before timer expires
- If timer expires before End Events

Note: Timeouts can only be configured from the Timeout Pattern dialog. The Timeout Pattern dialog allows configuring other patterns as triggers in combination with timeouts. Other pattern dialogs do not allow configuration of timeouts.

External/Manual Trigger

To set up an external trigger click the **External/Manual Trigger** category (see Figure 2.43 on page 83).


External\Manual Trigger
OK
Cancel

☑ Manual Trig

☑ External Trig

● High Active

○ Low Active

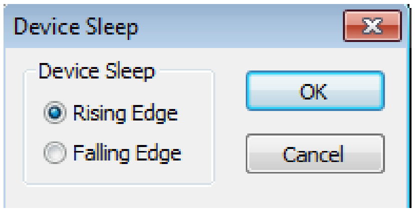
○ Toggle

For changing the external trig setting, go to "Configuration" menu and select "External Trig Setting".

Figure 2.43: External/Manual Trigger Dialog

Device Sleep

To set up Device Sleep click the **Device Sleep** category. Select **Rising Edge** or **Falling Edge**.


Device Sleep
Device Sleep
OK
Cancel

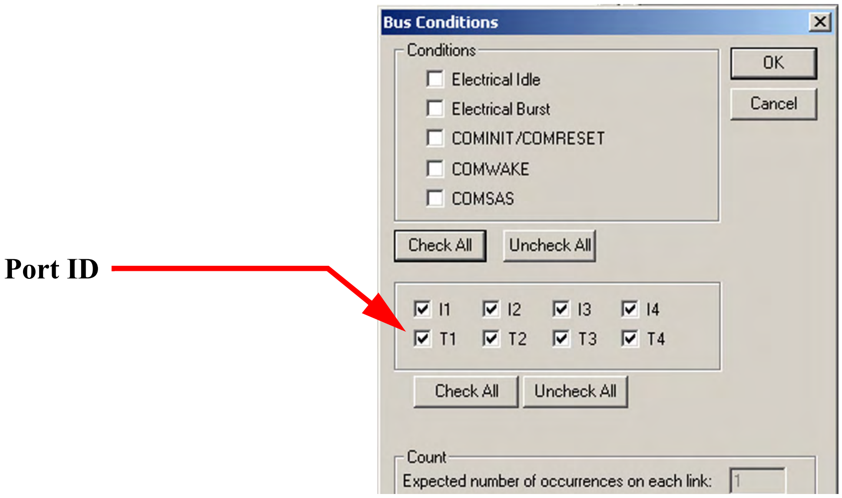
● Rising Edge

○ Falling Edge

Figure 2.44: Device Sleep Dialog

Bus Condition

Double-click **Bus Condition** in the Patterns window of the Capture Project dialog to open the Bus Conditions dialog.


Port ID
Bus Conditions
Conditions
OK
Cancel
Check All
Uncheck All
Check All
Uncheck All
Count

☐ Electrical Idle

☐ Electrical Burst

☐ COMINIT/COMRESET

☐ COMWAKE

☐ COMSAS

☑ I1 ☑ I2 ☑ I3 ☑ I4

☑ T1 ☑ T2 ☑ T3 ☑ T4

Expected number of occurrences on each link: 1

Figure 2.45: SAS: Bus Condition Dialog

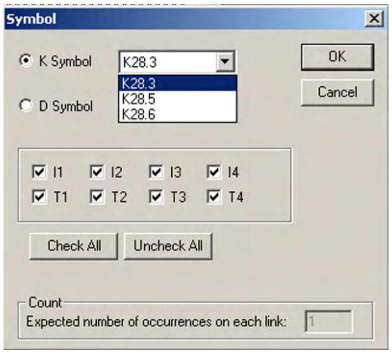
SAS vs. SATA: SATA Dialog separates the COMINIT and COMRESET check boxes and replaces COMWAKE with Host COMWAKE and COMSAS with Device COMWAKE.

Check the Conditions to trigger on and click **OK**.

Note: You can define triggering for specific ports by checking or unchecking Port IDs.

Symbol

Double-click **Symbol** in the Patterns window of the Capture Project dialog to open the Symbol dialog.


Symbol
● K Symbol
○ D Symbol
K28.3
K28.3
K28.5
K28.6
OK
Cancel
☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4
Check All
Uncheck All
Count

Expected number of occurrences on each link: 1

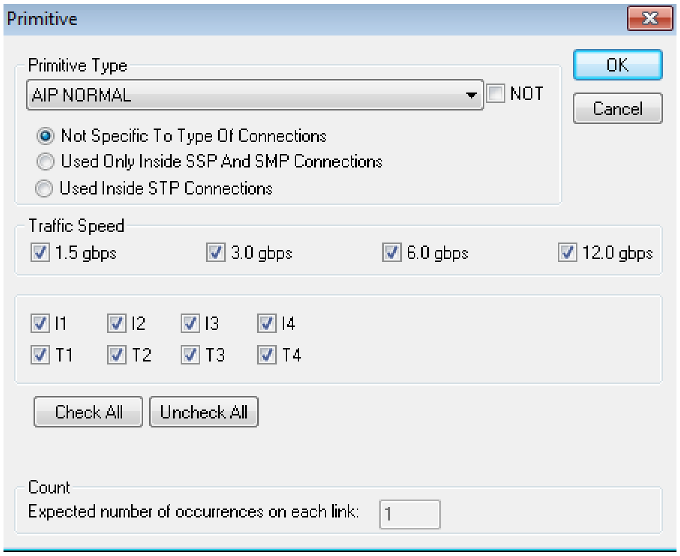
Figure 2.46: SAS: Symbol Dialog

Choose a symbol type by checking either the K Symbol or D Symbol option, then click the down arrow in the Symbol dropdown list, choose a symbol to trigger on, and click **OK**. Note that the D Symbol choice does not have a down arrow.

To choose a **D symbol**, click the D symbol option button and enter a Hex value.

Primitive

Double-click Primitive in the Patterns window of the Trigger dialog to open the Primitive dialog.


Primitive
OK
Cancel
Primitive Type
☐ NOT
Traffic Speed
☑ 1.5 gbps ☑ 3.0 gbps ☑ 6.0 gbps ☑ 12.0 gbps
☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4
Check All
Uncheck All
Count

Primitive Type: AIP NORMAL

● Not Specific To Type Of Connections
○ Used Only Inside SSP And SMP Connections
○ Used Inside STP Connections

Expected number of occurrences on each link: 1

Figure 2.47: SAS: Primitive Dialog

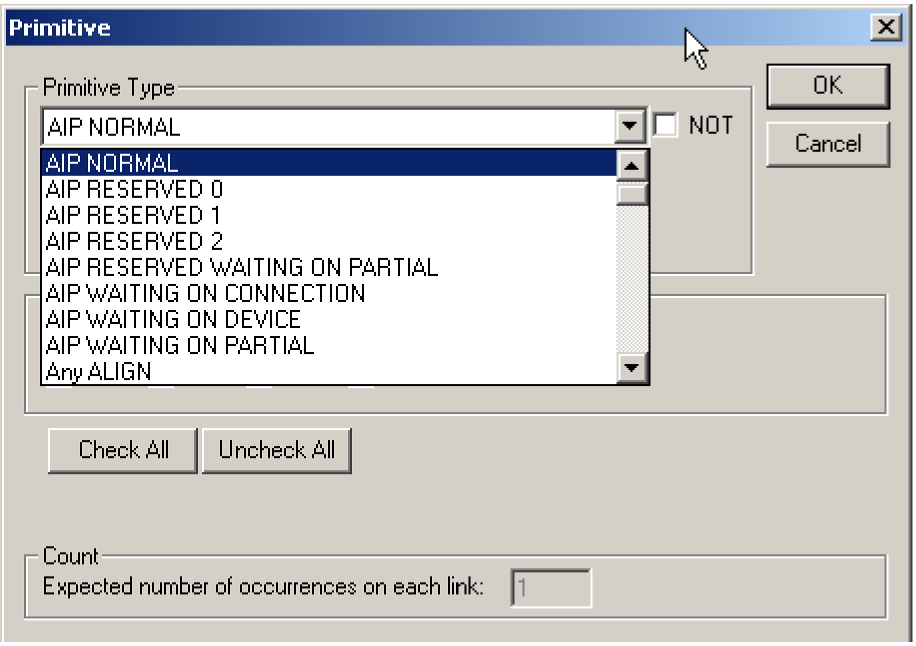
SAS vs. SATA: SATA Dialog has no radio buttons and has different drop-down options.

Click the down arrow next to the Primitive dropdown list, scroll the list to choose a primitive on which to trigger, and click **OK**.

Note: Users need to exclude the ALIGN capture for the SAS SOF / EOF trigger and exclude the XXX capture for the SATA SOF / EOF trigger, in order for the trigger to precisely display on those primitives in the Link Data frame.

Note: Check the box to the right of the Primitive Type to use the logical NOT.

.



Primitive Type: AIP NORMAL

Count

Expected number of occurrences on each link: 1

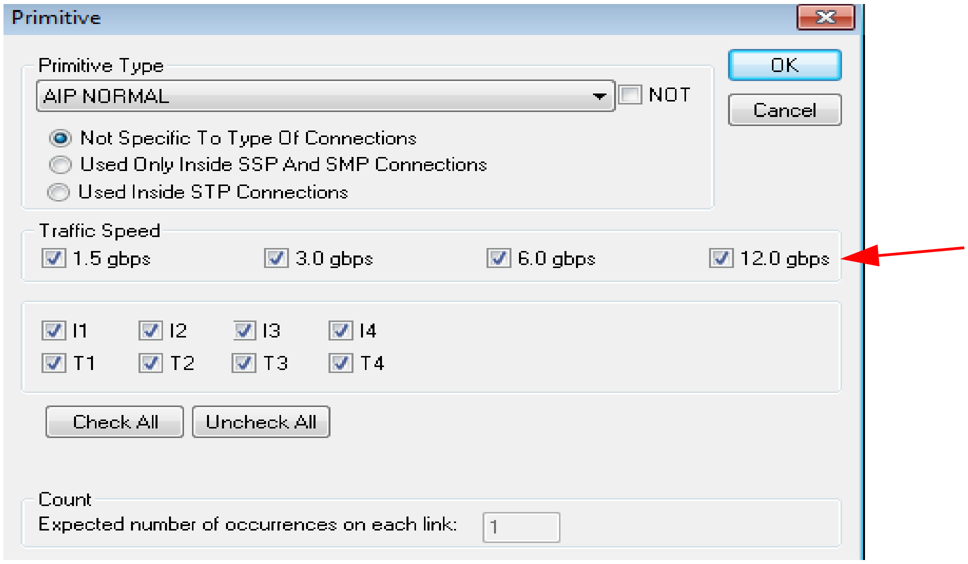
Primitive
☐ NOT
OK
Cancel
AIP NORMAL
AIP RESERVED 0
AIP RESERVED 1
AIP RESERVED 2
AIP RESERVED WAITING ON PARTIAL
AIP WAITING ON CONNECTION
AIP WAITING ON DEVICE
AIP WAITING ON PARTIAL
Any ALIGN
Check All
Uncheck All

Figure 2.48: SAS: Primitive Selection Choices

SAS vs. SATA: SATA Dialog has different choices.

Primitive Traffic Speed Option (SATA only)

You can change the speed for triggering as well as search by speed for Primitives.



Primitive Type: AIP NORMAL ☐ NOT

● Not Specific To Type Of Connections
○ Used Only Inside SSP And SMP Connections
○ Used Inside STP Connections

Traffic Speed: ☑ 1.5 gbps ☑ 3.0 gbps ☑ 6.0 gbps ☑ 12.0 gbps

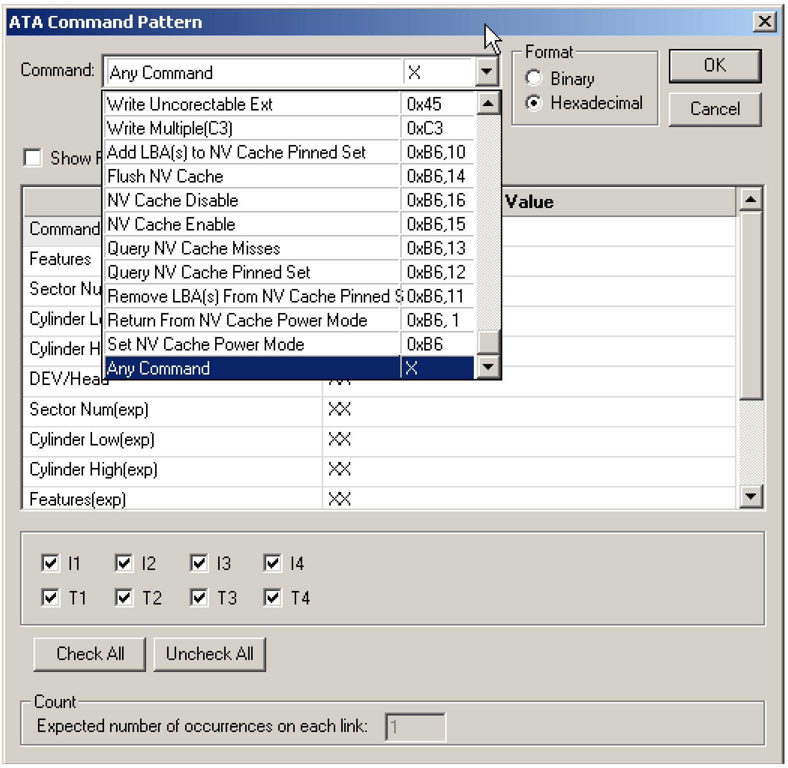
☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4

Count
Expected number of occurrences on each link: 1

Figure 2.49: Primitive Dialog

ATA Command

Double-click **ATA Command** in the Patterns window of the Trigger dialog to open the ATA Command dialog.



Command: Any Command X

Write Uncorectable Ext	0x45
Write Multiple(C3)	0xC3
Add LBA(s) to NV Cache Pinned Set	0xB6,10
Flush NV Cache	0xB6,14
NV Cache Disable	0xB6,16
NV Cache Enable	0xB6,15
Query NV Cache Misses	0xB6,13
Query NV Cache Pinned Set	0xB6,12
Remove LBA(s) From NV Cache Pinned S	0xB6,11
Return From NV Cache Power Mode	0xB6, 1
Set NV Cache Power Mode	0xB6
Any Command	X

Format: ○ Binary ● Hexadecimal

☐ Show F

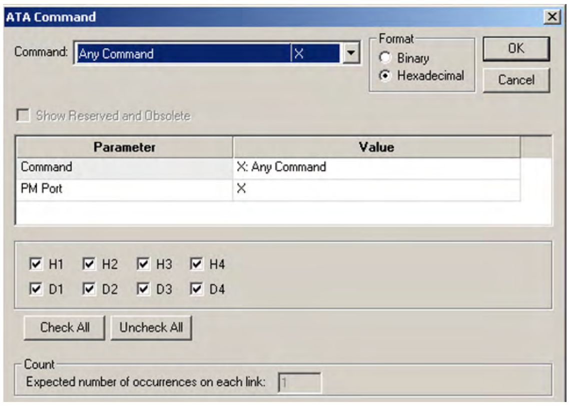
	Value
Command	
Features	
Sector Nu	
Cylinder L	
Cylinder H	
DEV/Hea	
Sector Num(exp)	XX
Cylinder Low(exp)	XX
Cylinder High(exp)	XX
Features(exp)	XX

☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4

Count
Expected number of occurrences on each link: 1

Figure 2.50: SAS: ATA Command Pattern Dialog

SAS vs. SATA: SATA Dialog has different dropdown options.



Command: Any Command X

Format: ○ Binary ● Hexadecimal

☐ Show Reserved and Obsolete

Parameter	Value
Command	X: Any Command
PM Port	X

☑ H1 ☑ H2 ☑ H3 ☑ H4
☑ D1 ☑ D2 ☑ D3 ☑ D4

Count
Expected number of occurrences on each link: 1

Figure 2.51: SATA: ATA Command Dialog

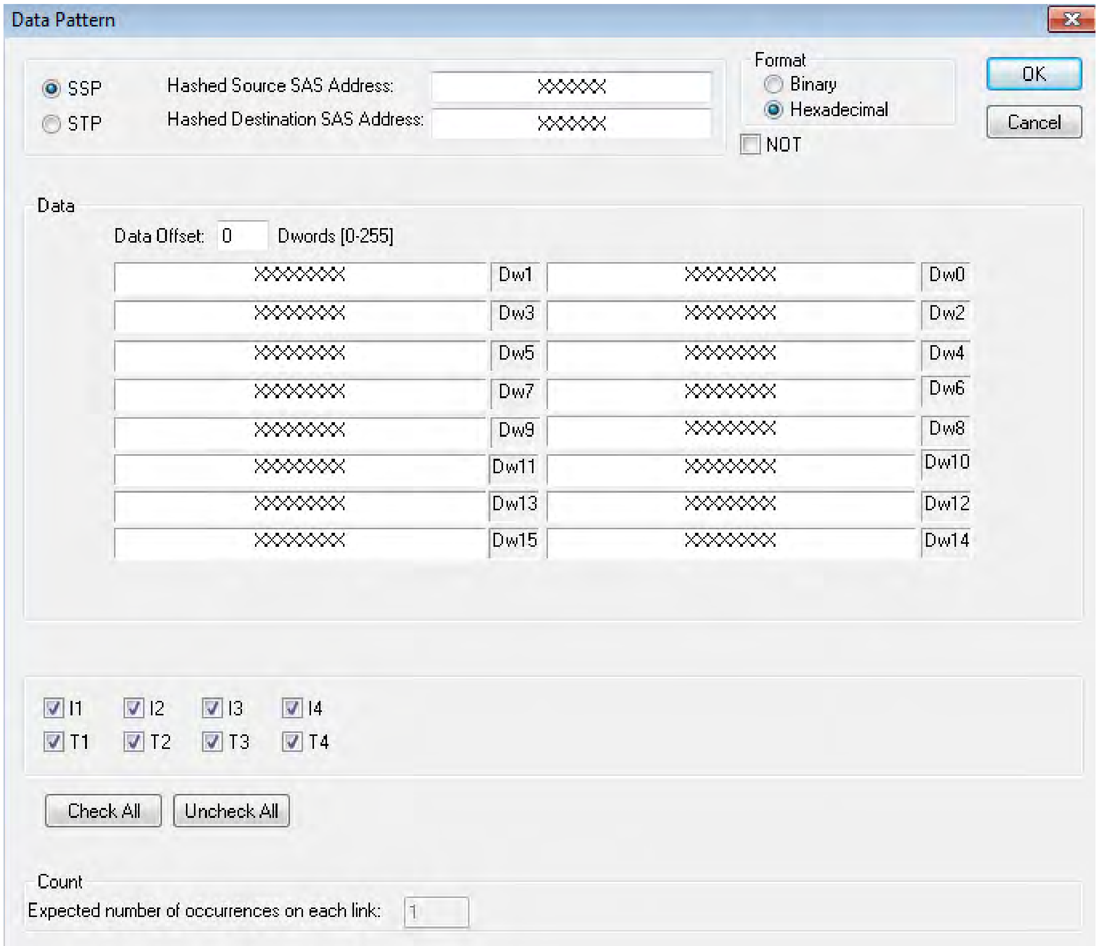
Click the down arrow next to the Command dropdown list, scroll the list to choose a command to trigger on, and click **OK**.

A powerful triggering choice is **Any Command**, which causes the analyzer to trigger on any ATA command.

Note: The command code and feature set are not the only parameters that describe an ATA command. For parameters such as LBA and sector count, you must use the **ATA Command Pattern** dialog.

Data Pattern

Double-click **Data Pattern** in the Patterns window of the Trigger dialog to open the Data Pattern dialog.



● SSP Hashed Source SAS Address: XXXXXX

○ STP Hashed Destination SAS Address: XXXXXX

Format: ○ Binary ● Hexadecimal

☐ NOT

Data

Data Offset: 0 Dwords [0-255]

XXXXXXXX	Dw1	XXXXXXXX	Dw0
XXXXXXXX	Dw3	XXXXXXXX	Dw2
XXXXXXXX	Dw5	XXXXXXXX	Dw4
XXXXXXXX	Dw7	XXXXXXXX	Dw6
XXXXXXXX	Dw9	XXXXXXXX	Dw8
XXXXXXXX	Dw11	XXXXXXXX	Dw10
XXXXXXXX	Dw13	XXXXXXXX	Dw12
XXXXXXXX	Dw15	XXXXXXXX	Dw14

☑ I1 ☑ I2 ☑ I3 ☑ I4

☑ T1 ☑ T2 ☑ T3 ☑ T4

Count

Expected number of occurrences on each link: 1

Figure 2.52: SAS: Data Pattern Dialog

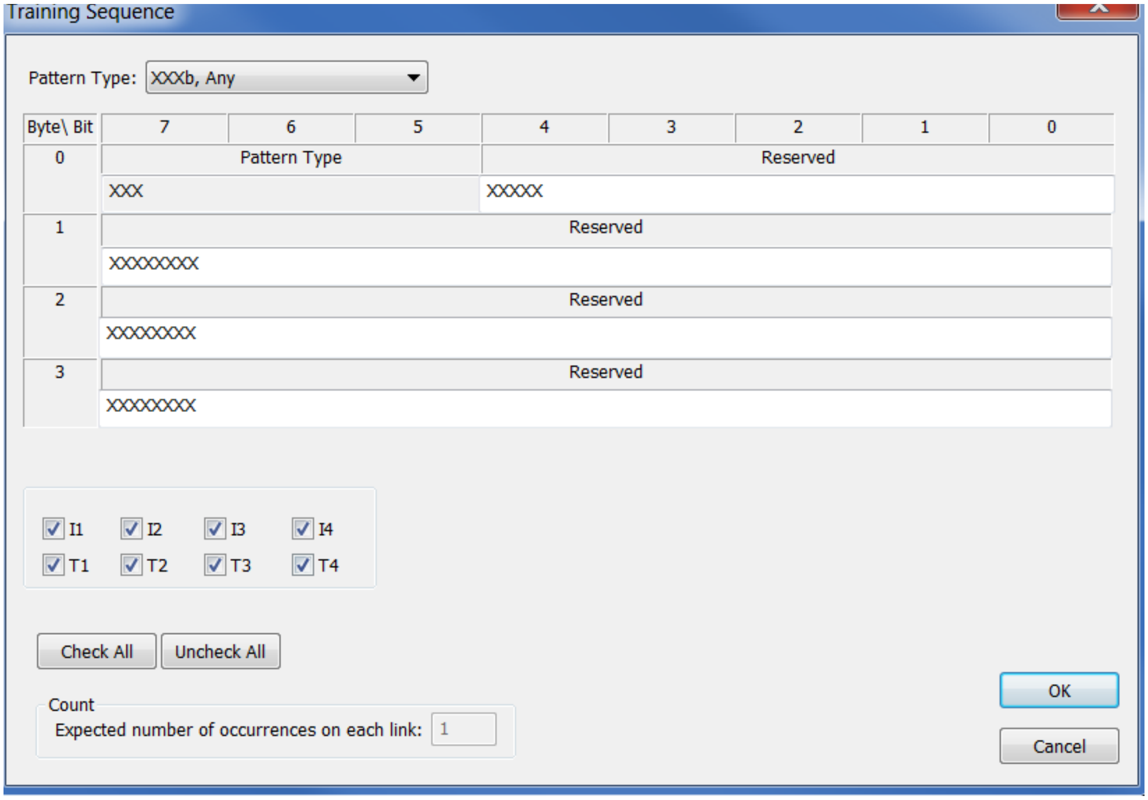
SAS vs. SATA: SATA Dialog shows Port at the top and does not show SSP or STP.

Define the data pattern for triggering and click **OK**.

Note: When entering the data pattern in the “Data” section of this screen, if you are reading the data pattern from a recorded trace, you must reverse the order of the bytes listed for each DWORD entered. For example, if you want to trigger on “00 01 02 03” (as displayed in the trace), you must enter this DWORD pattern as “03 02 01 00”.

Training Sequence

Double-click Training Sequence in the Patterns window of the Trigger dialog to open the Training Sequence dialog.



Pattern Type: XXXb, Any

Byte\ Bit	7	6	5	4	3	2	1	0
0	Pattern Type			Reserved				
	XXX			XXXXX				
1	Reserved							
	XXXXXXXX							
2	Reserved							
	XXXXXXXX							
3	Reserved							
	XXXXXXXX							

☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4

Count
Expected number of occurrences on each link: 1

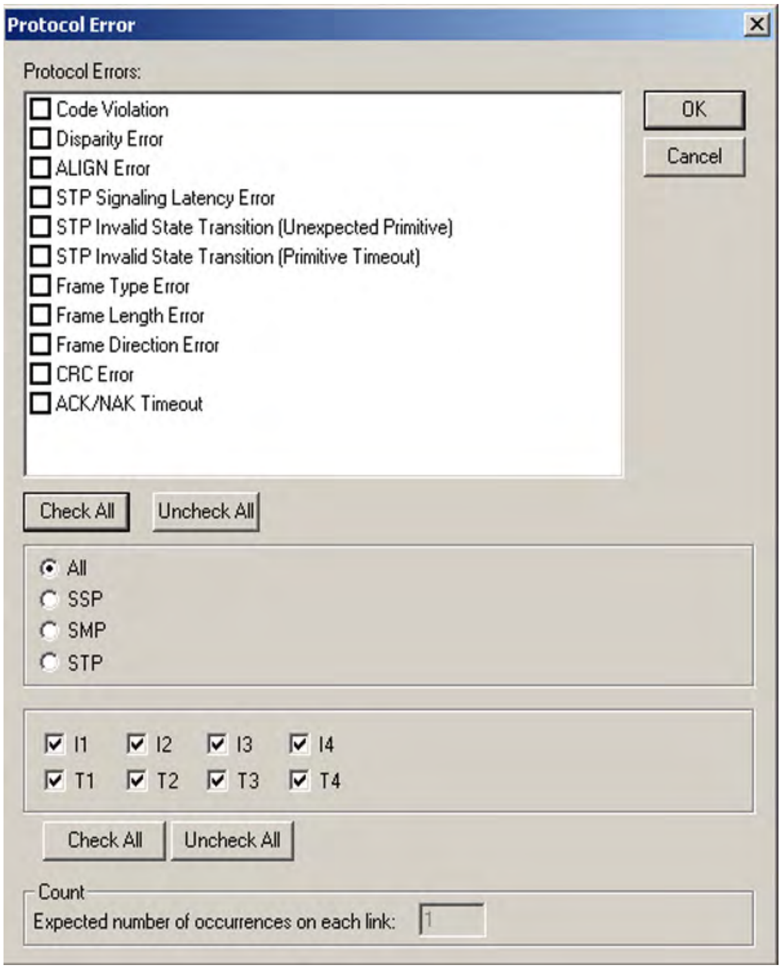
Figure 2.53: SAS: Training Sequence Dialog

SAS vs. SATA: Not available in SATA.

Define the training sequence for triggering and click **OK**.

Protocol Errors

Double-click **Protocol Errors** in the Patterns window of the Trigger dialog to open the Protocol Errors dialog.



Protocol Error

Protocol Errors:

☐ Code Violation
☐ Disparity Error
☐ ALIGN Error
☐ STP Signaling Latency Error
☐ STP Invalid State Transition (Unexpected Primitive)
☐ STP Invalid State Transition (Primitive Timeout)
☐ Frame Type Error
☐ Frame Length Error
☐ Frame Direction Error
☐ CRC Error
☐ ACK/NAK Timeout

● All
○ SSP
○ SMP
○ STP

☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4

Count
Expected number of occurrences on each link: 1

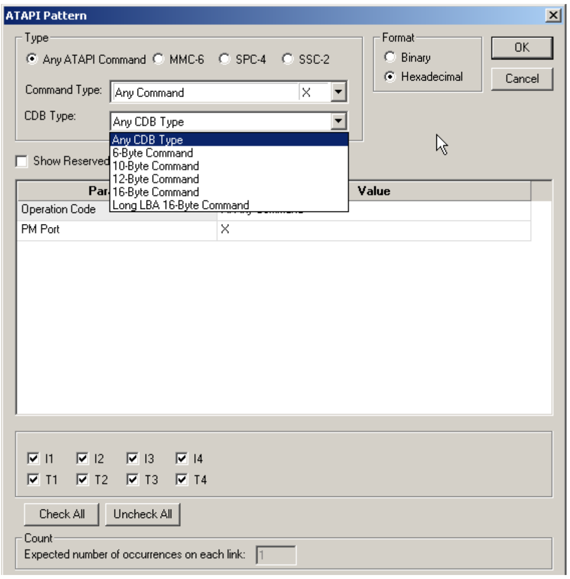
Figure 2.54: SAS: Protocol Errors Dialog

SAS vs. SATA: SATA Dialog shows Port and does not show SSP, SMP, or STP radio buttons.

Check the protocol error(s) on which to trigger and click **OK**.

ATAPI

Double-click **ATAPI** in the Patterns window of the Trigger dialog to open the ATAPI Patterns dialog.



ATAPI Pattern
Type
Format
OK
Cancel
Any CDB Type
6-Byte Command
10-Byte Command
12-Byte Command
16-Byte Command
Long LBA 16-Byte Command
Check All
Uncheck All
Count

Type: ● Any ATAPI Command ○ MMC-6 ○ SPC-4 ○ SSC-2

Command Type: Any Command X

CDB Type: Any CDB Type

Format: ○ Binary ● Hexadecimal

☐ Show Reserved

Par	Value
Operation Code	
PM Port	X

☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4

Expected number of occurrences on each link: 1

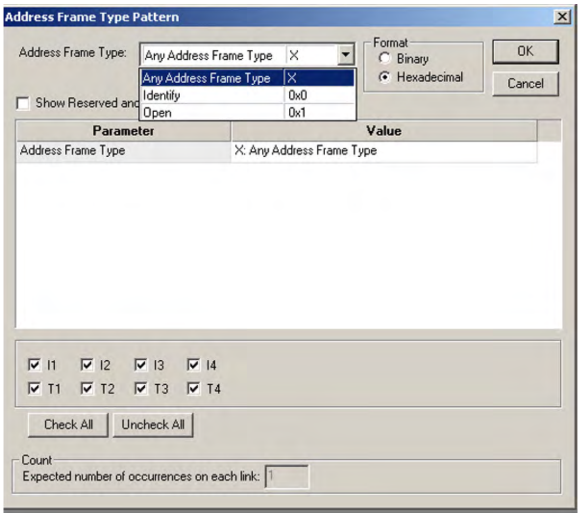
Figure 2.55: SAS: ATAPI Patterns Dialog

SAS vs. SATA: SATA Dialog has different dropdown options.

Click the down arrow next to the CDB dropdown list, scroll the list to choose a CDB Type, and click **OK**.

Address Frame (SAS only)

Double-click **Address Frame** in the Patterns window of the Trigger dialog to open the Address Frame Type Pattern dialog.



Address Frame Type Pattern
Format
OK
Cancel
Any Address Frame Type X
Identify 0x0
Open 0x1
Check All
Uncheck All
Count

Address Frame Type: Any Address Frame Type X

Format: ○ Binary ● Hexadecimal

☐ Show Reserved and

Parameter	Value
Address Frame Type	X: Any Address Frame Type

☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4

Expected number of occurrences on each link: 1

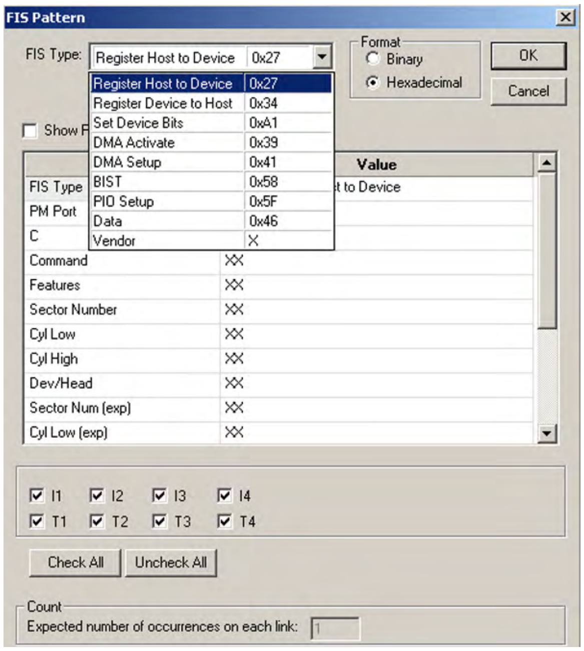
Figure 2.56: SAS: Address Frame Type Pattern Dialog

SAS vs. SATA: Not available in SATA.

Click the down arrow next to the Address Frame Type dropdown list, scroll the list to choose an address frame type on which to trigger, and click **OK**.

STP Frame

Double-click **STP Frame** in the Patterns window of the Trigger dialog to open the FIS Type dialog.



FIS Type: Register Host to Device 0x27

Register Host to Device	0x27
Register Device to Host	0x34
Set Device Bits	0xA1
DMA Activate	0x39
DMA Setup	0x41
BIST	0x58
PIO Setup	0x5F
Data	0x46
Vendor	X

Format: ○ Binary ● Hexadecimal

☐ Show F

	Value
FIS Type	t to Device
PM Port	
C	
Command	XX
Features	XX
Sector Number	XX
Cyl Low	XX
Cyl High	XX
Dev/Head	XX
Sector Num (exp)	XX
Cyl Low (exp)	XX

☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4

Count
Expected number of occurrences on each link: 1

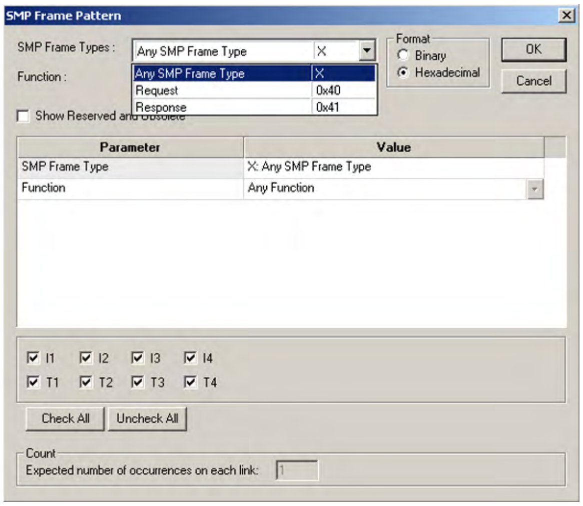
Figure 2.57: SATA: FIS Pattern Dialog

SAS vs. SATA: Not available in SATA.

Click the down arrow next to the FIS type dropdown list, scroll the list to choose an FIS type on which to trigger, and click **OK**.

SMP Frame (SAS only)

Double-click **SMP Frame** in the Patterns window of the Trigger dialog to open the SMP Frame Pattern dialog.


SMP Frame Pattern
Function :
Any SMP Frame Type X
Request 0x40
Response 0x41
Show Reserved and Obsolete
Format
Binary
OK
Cancel
Check All
Uncheck All
Count

SMP Frame Types : Any SMP Frame Type X

● Hexadecimal

Parameter	Value
SMP Frame Type	X: Any SMP Frame Type
Function	Any Function

☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4

Expected number of occurrences on each link: 1

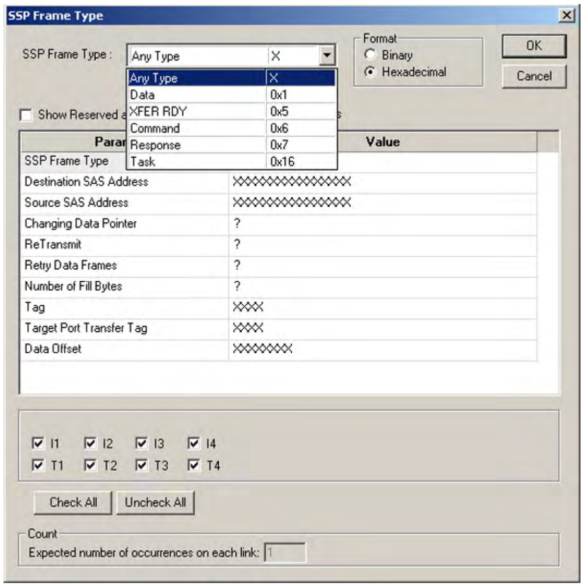
Figure 2.58: SAS: SMP Frame Pattern Dialog

SAS vs. SATA: Not available in SATA.

Click the down arrow next to the SMP Frame Types dropdown list and scroll the list to choose an SMP frame type on which to trigger. Then click the down arrow next to the Function dropdown list, choose a function, and click **OK**.

SSP Frame (SAS only)

Double-click **SSP Frame** in the Patterns window of the Trigger dialog to open the SSP Frame Pattern dialog.


SSP Frame Type
Any Type X
Data 0x1
XFER RDY 0x5
Command 0x6
Response 0x7
Task 0x16
Show Reserved a
Format
Binary
OK
Cancel
Check All
Uncheck All
Count

SSP Frame Type : Any Type X

● Hexadecimal

Parameter	Value
SSP Frame Type	
Destination SAS Address	XXXXXXXXXXXXXXXX
Source SAS Address	XXXXXXXXXXXXXXXX
Changing Data Pointer	?
ReTransmit	?
Retry Data Frames	?
Number of Fill Bytes	?
Tag	XXXX
Target Port Transfer Tag	XXXX
Data Offset	XXXXXXXX

☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4

Expected number of occurrences on each link: 1

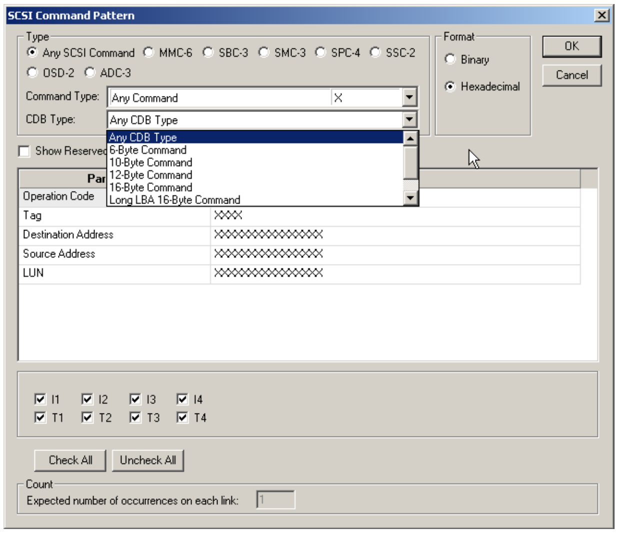
Figure 2.59: SAS: SSP Frame Type Dialog

SAS vs. SATA: Not available in SATA.

Click the down arrow next to the SSP Frame Type dropdown list, scroll the list to choose an SSP frame type on which to trigger, and click **OK**.

SCSI Command (SAS only)

Double-click **SCSI Command** in the Patterns window of the Trigger dialog to open the SCSI Command Pattern dialog.



SCSI Command Pattern

Type

● Any SCSI Command ○ MMC-6 ○ SBC-3 ○ SMC-3 ○ SPC-4 ○ SSC-2
○ OSD-2 ○ ADC-3

Command Type: Any Command X

CDB Type: Any CDB Type

Format

○ Binary
● Hexadecimal

☐ Show Reserved

Operation Code	
Tag	XXXX
Destination Address	XXXXXXXXXXXXXXXX
Source Address	XXXXXXXXXXXXXXXX
LUN	XXXXXXXXXXXXXXXX

☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4

Count

Expected number of occurrences on each link: 1

Any CDB Type
6-Byte Command
10-Byte Command
12-Byte Command
16-Byte Command
Long LBA 16-Byte Command
Par
OK
Cancel
Check All
Uncheck All

Figure 2.60: SAS: SCSI Command Pattern Dialog

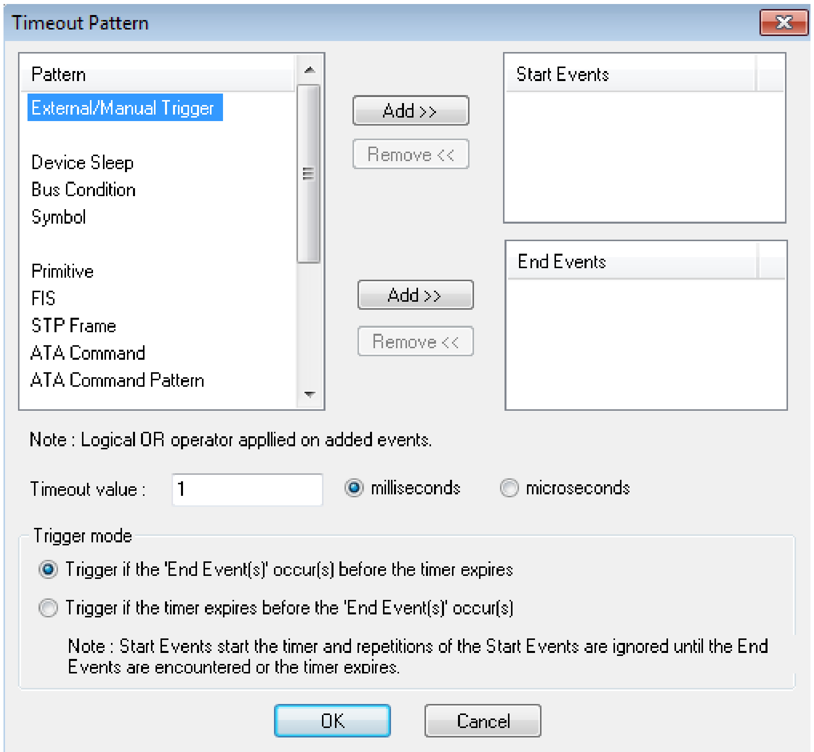
SAS vs. SATA: Not available in SATA.

Click the down arrow next to the CDB dropdown list, scroll the list to choose a CDB Type, and click **OK**.

Timeout

Choosing timeout as a trigger condition allows you to define a timer with a timeout value that is reset to 0 and starts by occurrence of any events that you add to the Start Events list. You can then add one or more events to the End Events list and then choose a trigger to occur if an End event occurs before the timer expires, or if the timer expires before the occurrence of an end event.

You add and define the Start and End events identically to the way that you define and add patterns to capture.


Timeout Pattern
Pattern
External/Manual Trigger
Device Sleep
Bus Condition
Symbol
Primitive
FIS
STP Frame
ATA Command
ATA Command Pattern
Add >>
Remove <<
Start Events
Add >>
Remove <<
End Events
Trigger mode
OK
Cancel

Note : Logical OR operator appllied on added events.

Timeout value : 1 ● milliseconds ○ microseconds

Trigger mode

● Trigger if the 'End Event(s)' occur(s) before the timer expires

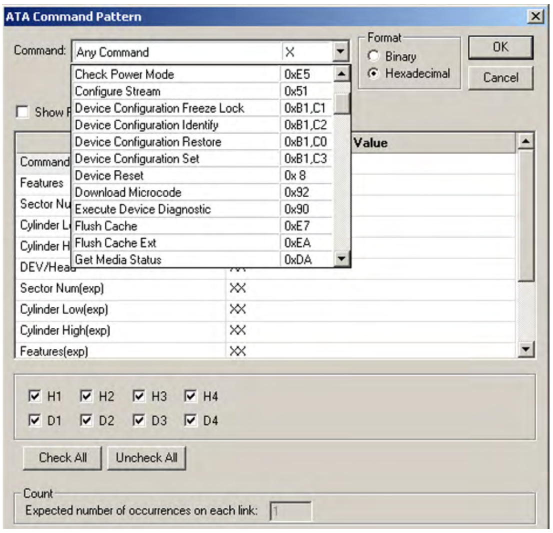
○ Trigger if the timer expires before the 'End Event(s)' occur(s)

Note : Start Events start the timer and repetitions of the Start Events are ignored until the End Events are encountered or the timer expires.

Figure 2.61: Timeout Pattern Dialog

ATA Command Pattern (SATA only)

Double-click **ATA Command Pattern** to open the ATA command pattern selection dialog.



Command: Any Command X

Check Power Mode	0xE5
Configure Stream	0x51
Device Configuration Freeze Lock	0xB1,C1
Device Configuration Identify	0xB1,C2
Device Configuration Restore	0xB1,C0
Device Configuration Set	0xB1,C3
Device Reset	0x 8
Download Microcode	0x92
Execute Device Diagnostic	0x90
Flush Cache	0xE7
Flush Cache Ext	0xEA
Get Media Status	0xDA

Format: ○ Binary ● Hexadecimal

	Value
Command	
Features	
Sector Nu	
Cylinder L	
Cylinder H	
DEV/Head	
Sector Num(exp)	XX
Cylinder Low(exp)	XX
Cylinder High(exp)	XX
Features(exp)	XX

☑ H1 ☑ H2 ☑ H3 ☑ H4
☑ D1 ☑ D2 ☑ D3 ☑ D4

Count
Expected number of occurrences on each link: 1

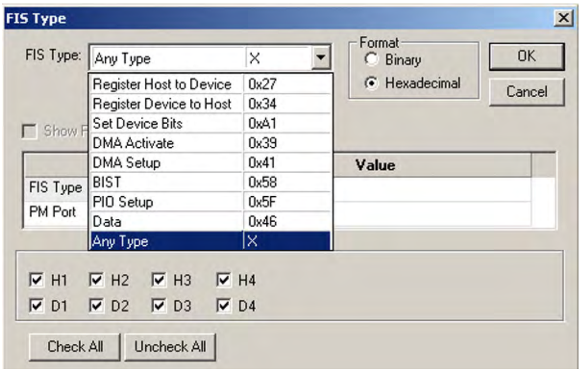
Figure 2.62: SATA: ATA Command Pattern Dialog

SAS vs. SATA: Not available in SAS.

Click the down arrow next to the Command list box, choose an ATA command, and click **OK**.

FIS (SATA only)

Double-click **Frame Information Structure (FIS)** to open the FIS Type selection dialog.



FIS Type: Any Type X

Register Host to Device	0x27
Register Device to Host	0x34
Set Device Bits	0xA1
DMA Activate	0x39
DMA Setup	0x41
BIST	0x58
PIO Setup	0x5F
Data	0x46
Any Type	X

Format: ○ Binary ● Hexadecimal

	Value
FIS Type	
PM Port	

☑ H1 ☑ H2 ☑ H3 ☑ H4
☑ D1 ☑ D2 ☑ D3 ☑ D4

Figure 2.63: SATA: FIS Type Dialog

SAS vs. SATA: Not available in SAS.

Click the down arrow next to the Type drop-down list box, choose a FIS type on which to trigger, and click **OK**. Repeat for additional types.

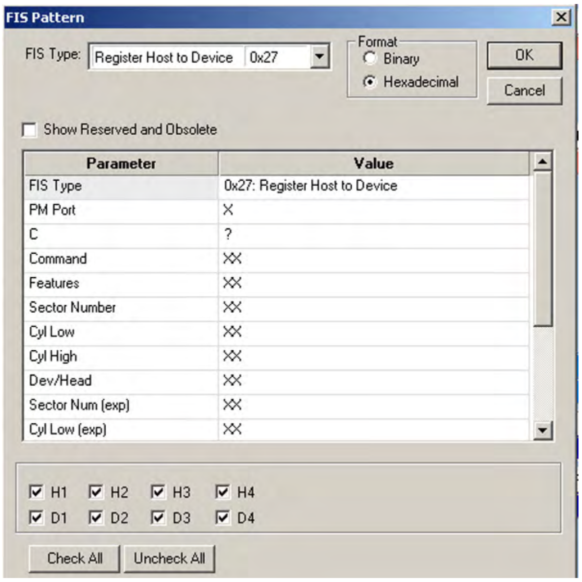
Available FIS Types

- Register Host to Device
- Register Device to Host
- Set Device Bit
- DMA Activate
- Any Type
- DMA Setup
- BIST
- PIO Setup
- Data

Note: You cannot trigger on a Vendor FIS.

FIS Pattern (SATA only)

Double-click **FIS Pattern** to open the FIS Pattern selection dialog.



FIS Type: Register Host to Device 0x27

Format: ○ Binary ● Hexadecimal

☐ Show Reserved and Obsolete

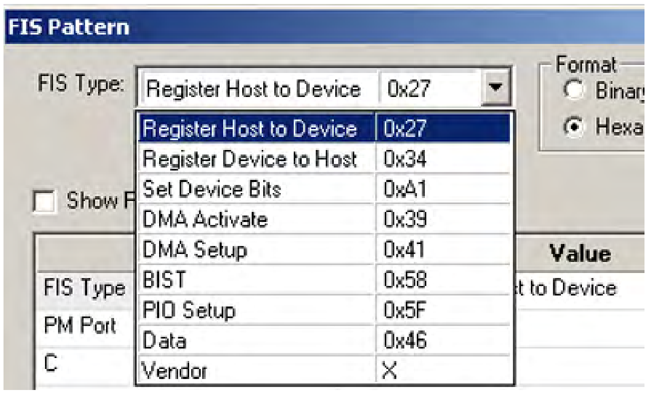
Parameter	Value
FIS Type	0x27: Register Host to Device
PM Port	X
C	?
Command	XX
Features	XX
Sector Number	XX
Cyl Low	XX
Cyl High	XX
Dev/Head	XX
Sector Num (exp)	XX
Cyl Low (exp)	XX

☑ H1 ☑ H2 ☑ H3 ☑ H4
☑ D1 ☑ D2 ☑ D3 ☑ D4

Figure 2.64: SATA: FIS Pattern Dialog

SAS vs. SATA: Not available in SAS.

The FIS Pattern dialog opens with the default FIS Type as **Register Host to device.** To choose another available FIS Type, click the down arrow next to the FIS Type list box.



FIS Type: Register Host to Device 0x27

Register Host to Device	0x27
Register Device to Host	0x34
Set Device Bits	0xA1
DMA Activate	0x39
DMA Setup	0x41
BIST	0x58
PIO Setup	0x5F
Data	0x46
Vendor	X

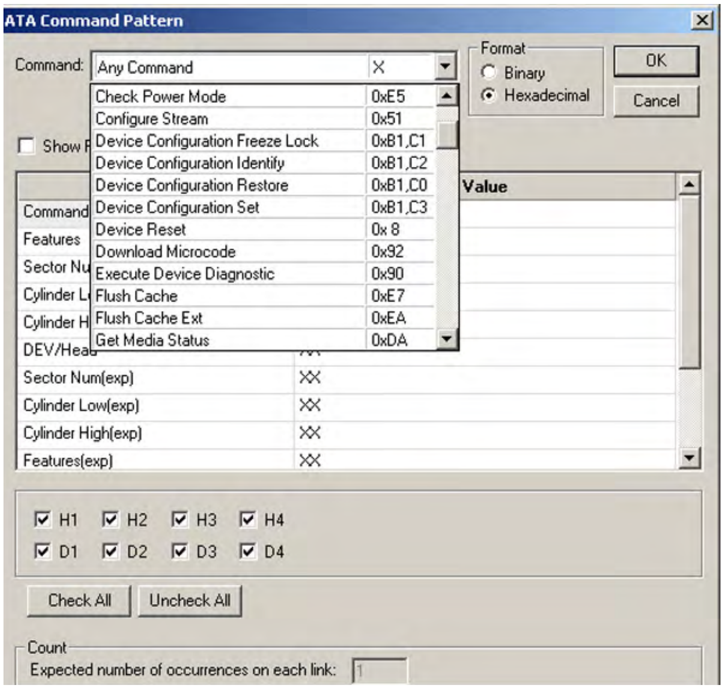
SATA: FIS Pattern Dialog Choices

SAS vs. SATA: Not available in SAS.

Choose a FIS Type and complete the corresponding dialog.

ATA Command Pattern (SATA only)

Double-click **ATA Command** to open the ATA Command Pattern selection dialog.



Command: Any Command X

Check Power Mode	0xE5
Configure Stream	0x51
Device Configuration Freeze Lock	0xB1,C1
Device Configuration Identify	0xB1,C2
Device Configuration Restore	0xB1,C0
Device Configuration Set	0xB1,C3
Device Reset	0x 8
Download Microcode	0x92
Execute Device Diagnostic	0x90
Flush Cache	0xE7
Flush Cache Ext	0xEA
Get Media Status	0xDA

○ Binary
● Hexadecimal

☐ Show F

	Value
Command	
Features	
Sector Nu	
Cylinder L	
Cylinder H	
DEV/Hea	
Sector Num(exp)	XX
Cylinder Low(exp)	XX
Cylinder High(exp)	XX
Features(exp)	XX

☑ H1 ☑ H2 ☑ H3 ☑ H4
☑ D1 ☑ D2 ☑ D3 ☑ D4

Expected number of occurrences on each link: 1

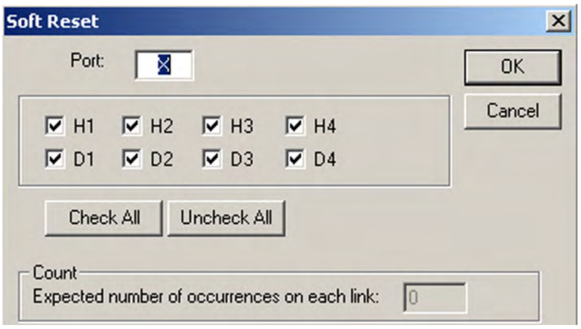
Figure 2.65: SATA: ATA Command Pattern Dialog

SAS vs. SATA: Not available in SAS.

Click the down arrow next to the Command list box, choose an ATA command, and click **OK**.

Soft Reset (SATA only)

Double-click **Soft Reset** to open the Soft Reset dialog.



Port: X

☑ H1 ☑ H2 ☑ H3 ☑ H4
☑ D1 ☑ D2 ☑ D3 ☑ D4

Expected number of occurrences on each link: 0

Figure 2.66: SATA: Soft Reset Dialog

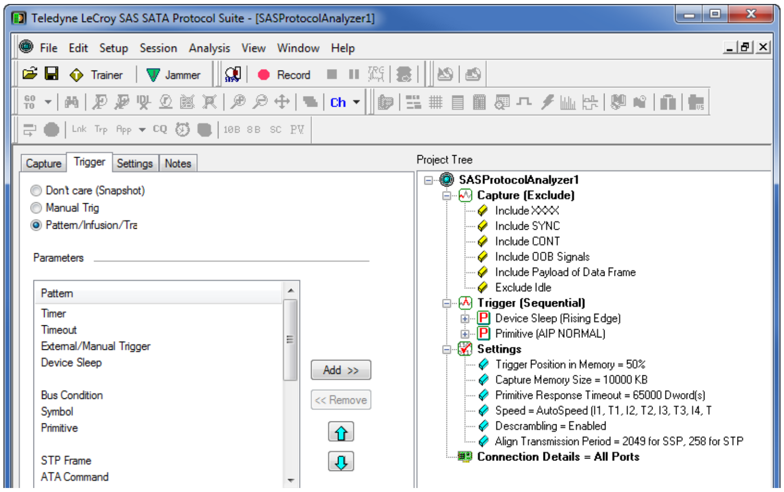
SAS vs. SATA: Not available in SAS.

Sequential Trigger Mode

In the Sequential Trigger mode, triggering occurs whenever the system detects a specific sequence of patterns. The order in which you define triggering patterns establishes the sequence. You must define at least two patterns to enable the selection of the sequential trigger mode.

Note: Primitives and Symbols or Frames occurring very close together on different ports cause an error in triggering.

To define a triggering sequence, select more than one pattern, then check the **Define Sequential Trigger Mode** check box.


Teledyne LeCroy SAS SATA Protocol Suite - [SASProtocolAnalyzer1]
File Edit Setup Session Analysis View Window Help
Trainer
Jammer
Record
Ch
Capture Trigger Settings Notes
○ Don't care (Snapshot)
○ Manual Trig
● Pattern/Infusion/Tr
Parameters
Pattern
Timer
Timeout
External/Manual Trigger
Device Sleep
Bus Condition
Symbol
Primitive
STP Frame
ATA Command
Add >>
<< Remove
Project Tree

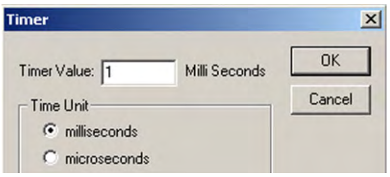
SASProtocolAnalyzer1
- Capture (Exclude)
  - Include XXXX
  - Include SYNC
  - Include CONT
  - Include OOB Signals
  - Include Payload of Data Frame
  - Exclude Idle
- Trigger (Sequential)
  - Device Sleep (Rising Edge)
  - Primitive (AIP NORMAL)
- Settings
  - Trigger Position in Memory = 50%
  - Capture Memory Size = 10000 KB
  - Primitive Response Timeout = 65000 Dword(s)
  - Speed = AutoSpeed (I1, T1, I2, T2, I3, T3, I4, T
  - Descrambling = Enabled
  - Align Transmission Period = 2049 for SSP, 258 for STP
- Connection Details = All Ports

Figure 2.67: SAS: Select Sequential Trigger Mode

SAS vs. SATA: SATA Dialog has different patterns.

Timer

The sequential triggering mode offers the option of triggering on a timer or inserting a timer in the triggering sequence to delay detection of the next pattern in the sequence. To insert a timer in the trigger list, double-click **Timer** to open the Timer definition dialog.


Timer
OK
Cancel

Timer Value: 1 Milli Seconds

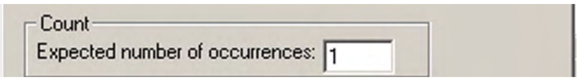
Time Unit
● milliseconds
○ microseconds

Enter a **Time Value**, choose the **Time Unit**, and click **OK**.

Defining Patterns

The definition of patterns for the sequential trigger mode is identical to the Any Trigger mode, with the following exception:

In the sequential triggering mode, the definition dialogs for these triggering patterns have an additional setting, to count the number of occurrences. This setting allows you to specify the number of times that the pattern must occur before triggering or proceeding in the trigger sequence.



Count
Expected number of occurrences: 1

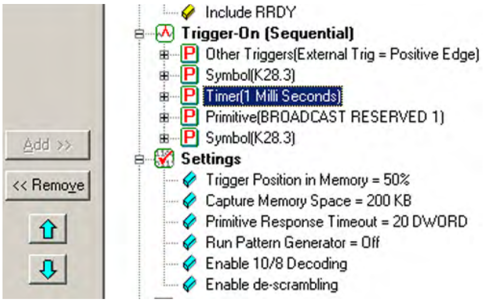
Figure 2.68: Number of Occurrences Dialog

Note: The system counts events on each link independently, causing a trigger whenever the number of occurrences on any link equals the specified value.

Triggering Order

As you define and add triggering patterns, they display under the Trigger category in the Project Tree sequentially, in the order in which you entered them. When the project runs, the Analyzer detects the occurrence of each pattern in order and triggers on the last one.

You can reorder the sequence of triggering patterns. To change the sequence order, highlight a trigger pattern and use the **Up** or **Down** arrow to move it to a new position.



Include RRDY
Trigger-On (Sequential)
- Other Triggers(External Trig = Positive Edge)
- Symbol(K28.3)
- Timer(1 Milli Seconds)
- Primitive(BROADCAST RESERVED 1)
- Symbol(K28.3)

Settings
- Trigger Position in Memory = 50%
- Capture Memory Space = 200 KB
- Primitive Response Timeout = 20 DWORD
- Run Pattern Generator = Off
- Enable 10/8 Decoding
- Enable de-scrambling

Figure 2.69: Triggering Order

Pre-Trigger

You can set the amount of data to capture before and after the trigger, as a percentage of pre-trigger, between 1% and 99%. Position the pre-trigger slider to a percentage. This feature allows the evaluation of bus activity leading up to and after the triggering event. Figure 2.70 illustrates the operation of pre-trigger in data memory.

Pre-trigger data is capture of the specified percentage of data prior to the triggering event. It cannot be guaranteed and may be 0. This can occur when the triggering event occurs before storing the required amount of pre-trigger event data. In such a case, the data display shows fewer than the specified data points prior to the triggering event.

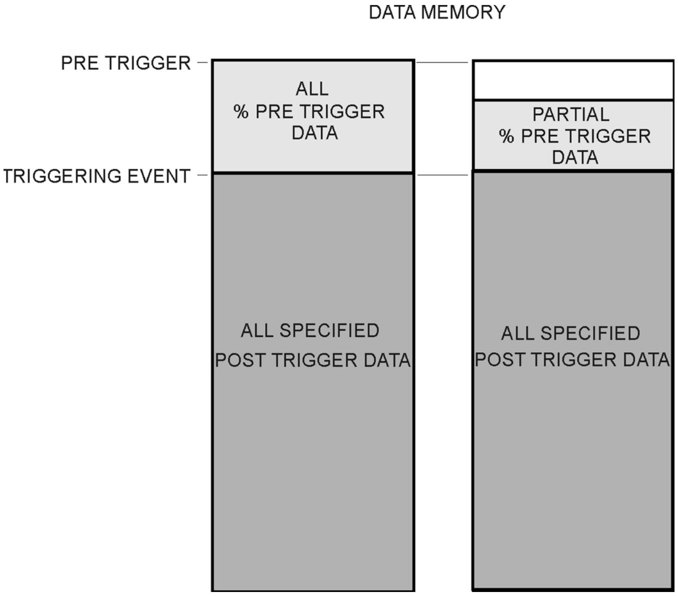
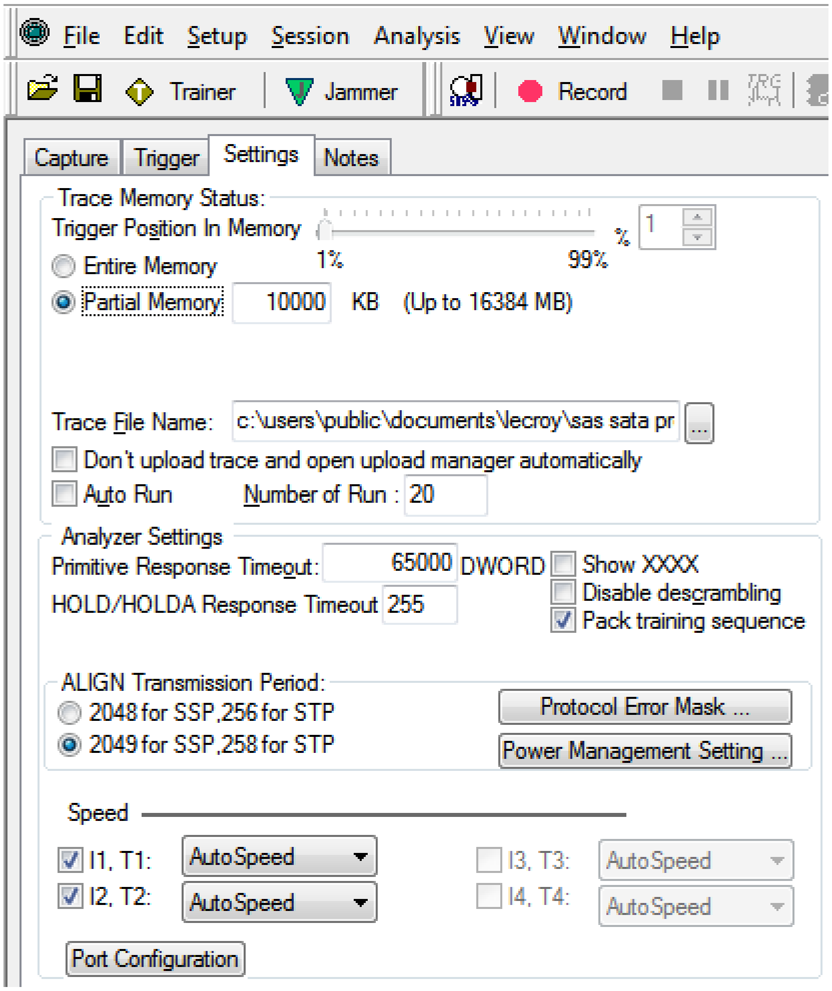

DATA MEMORY
PRE TRIGGER
TRIGGERING EVENT
ALL % PRE TRIGGER DATA
PARTIAL % PRE TRIGGER DATA
ALL SPECIFIED POST TRIGGER DATA
ALL SPECIFIED POST TRIGGER DATA

Figure 2.70: Pre-Trigger Example, 20% Pre-Trigger

2.2.17 Project Settings

To set project options, click the **Settings** tab (see Figure 2.71 on page 102).



Trace Memory Status:

Trigger Position In Memory 1% 99% 1 %

○ Entire Memory

● Partial Memory 10000 KB (Up to 16384 MB)

Trace File Name: c:\users\public\documents\lecroy\sas sata pr

☐ Don't upload trace and open upload manager automatically

☐ Auto Run Number of Run : 20

Analyzer Settings

Primitive Response Timeout: 65000 DWORD

HOLD/HOLDA Response Timeout 255

☐ Show XXXX

☐ Disable descrambling

☑ Pack training sequence

ALIGN Transmission Period:

○ 2048 for SSP,256 for STP

● 2049 for SSP,258 for STP

Speed

☑ I1, T1: AutoSpeed

☑ I2, T2: AutoSpeed

☐ I3, T3: AutoSpeed

☐ I4, T4: AutoSpeed

Figure 2.71: SAS: Setting Project Options

SAS vs. SATA: For the ALIGN Transmission Period section, SATA Dialog shows options 256 and 258, and does not show 2048 or 2049.
For Speed, SATA Dialog shows H1, D1 to H4, D4 and does not show I1, T1 to I4, T4.
SATA Dialog does not show MUX Setting button.

SATA dialog shows DevSlp min detection time field to enter the debouncer value.

Memory Settings

The Trace Memory Status section has the following fields.

Trigger Position

Pre-Trigger defaults to 50%, which defines the percentage of data to capture before and after the triggering event. You can change this percentage by dragging the slider.

Capture of the specified percentage of the data prior to the triggering event cannot be guaranteed and may be 0. This can occur if the triggering event occurs before storing the required amount of pre-trigger event data. In such a case, the data display shows fewer than the specified data points prior to the triggering event. For more detail, (see “Pre-Trigger” on page 101.)

Note: Trigger Position only works when the triggering option is Pattern.

In certain cases, when one port is recording traffic and filling up the memory much faster than another port, you might see traffic appearing only on one port for a while, and the other port's traffic will only appear later. This occurs as a function of the trigger position, and is normal, expected behavior of the analyzer.

Trace File Name

Click the ellipses next to the Sample File Name text box and choose a file name and location for the results of your current project.

Auto Run

To repeat the current capture and trigger setup automatically, check the Auto Run checkbox and enter the number of times in the Number of Run text box. The capture and trigger repeat automatically for the specified number of times, and the results are saved in consecutively numbered Sample.scs files.

Memory Size

In the Protocol Analyzer Settings tab, you can allot memory for the trace recording. Check **Entire Memory** to allow recording to use the whole memory, to capture the maximum amount of trace data. (Minimum size of memory is 2 GB. Maximum size of memory is 16 GB.)

Partial Memory

To reduce the memory size, check **Partial Memory** and enter a buffer size in kilobytes, up to the memory size in megabytes.

Note: If the size of a data packet exceeds the buffer memory allocation, the project runs, but no data capture occurs. You must increase buffer memory size to a value greater than the packet size.

Segmented Memory

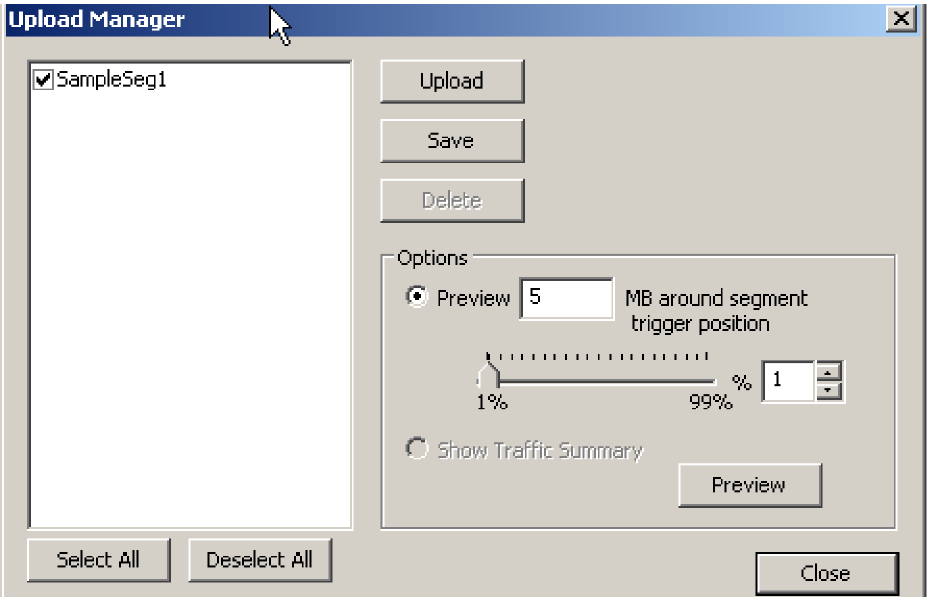
Alternatively, you can use **Segmented Memory**. Enter an integer **# of Segment**, from 1 to 32, then enter an integer **Segment Size** in kilobytes, up to the memory size in megabytes divided by the number of segments. The default segment size is 10 MB.

Each time a trigger condition occurs, the system records a new segment. You can use a Snapshot or Pattern trigger, but not Manual Trigger. As the same trigger automatically repeats, the system makes the number of segments that you entered.

Upload Manager

To upload segments manually in the Upload Manager, select the **Don’t upload segments and open upload manager automatically** checkbox.
To upload segments automatically for display as the system creates them, do not select the checkbox.

To view segmented trace files, click the **Upload Manager** button, beside the Record button, to display the Upload Manager dialog (see Figure 2.72 on page 104.)



Upload Manager

☑ SampleSeg1

Options

● Preview 5 MB around segment trigger position

% 1

○ Show Traffic Summary

Figure 2.72: Upload Manager Dialog

The dialog displays the segments in the format Segment1, Segment2, and so on.

Select segments by clicking the checkbox. You can also **Select All** or **Deselect All** segments.

You can **Upload** segments for display, **Save** segments as sample files, and **Delete** segments.

The **Preview** radio button allows a preview of an integer number of megabytes around the trigger position. You can set the trigger position as a percentage and select the segment number. Click the radio button to **Show Traffic Summary** with the preview. To show the preview, click the **Preview** button.

2.2.18 Analyzer Settings

Primitive Response Timeout

The Primitive Response Timeout parameter specifies the number of DWORDs between two pair primitives after which the analyzer detects a protocol error. Default value is 65000. When host or device sends a primitive, such as X_RDY, HOLD, or WTRM, it expects device or host to reply with a primitive, such as R_RDY, HOLDA, or R_OK. This parameter detects FIS Signaling Latency error, between HOLD and HOLDA, and FIS State Transition error, between X_RDY and R_RDY, between SOF and EOF, or between WTRM and R_OK or R_ERR.You can set a trigger on these protocol errors.

Disable Scrambling

If checked, causes the Analyzer to assume that no traffic is scrambled. By default, the Analyzer assumes the scrambling state of the devices under test

Show XXXX value

Check this option to display XXXX values.

Pack training sequence

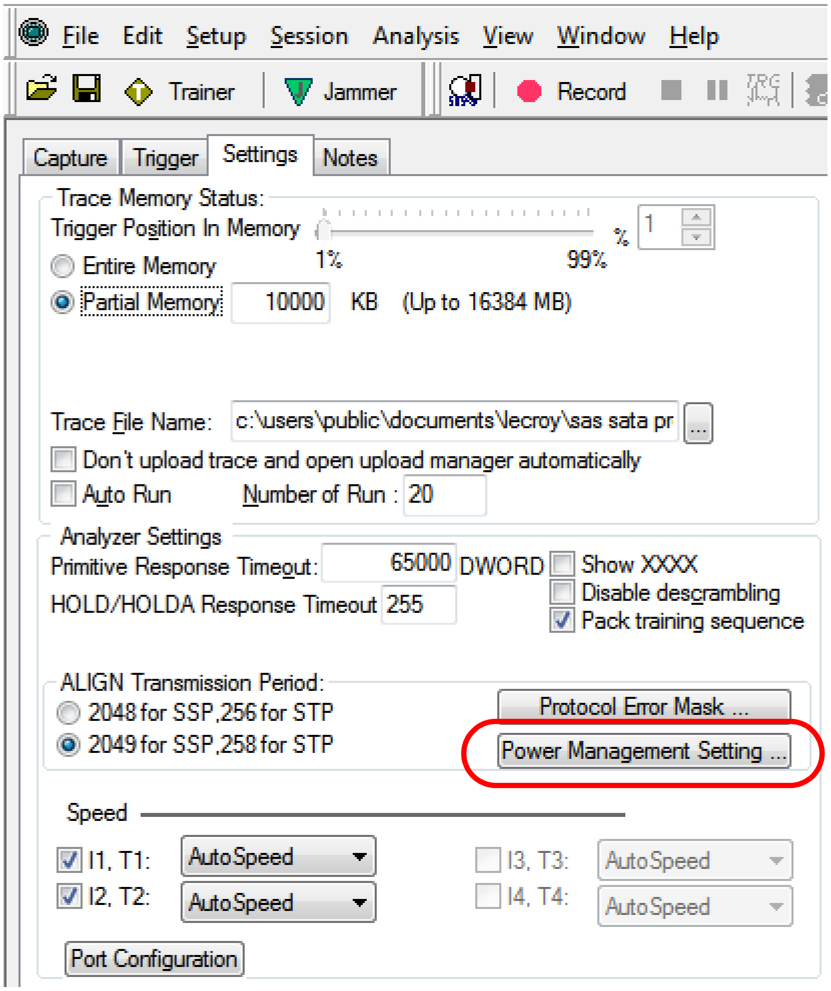
Checking this option allows hiding the details of the Training Sequence, which can take up large portions of the trace unless packed.

ALIGN Transmission Period (differs for SAS and SATA)

Choose the ALIGN Transmission Period for SSP and STP by clicking the corresponding option button, then open the Protocol Error Mask dialog.

Power Management Setting

Click the Power Management Setting button to open the Power Management Setting dialog.


File
Edit
Setup
Session
Analysis
View
Window
Help
Trainer
Jammer
Record
Capture
Trigger
Settings
Notes
1%
99%
Protocol Error Mask ...
Power Management Setting ...
Port Configuration

Trace Memory Status:
Trigger Position In Memory 1 %
○ Entire Memory
● Partial Memory 10000 KB (Up to 16384 MB)

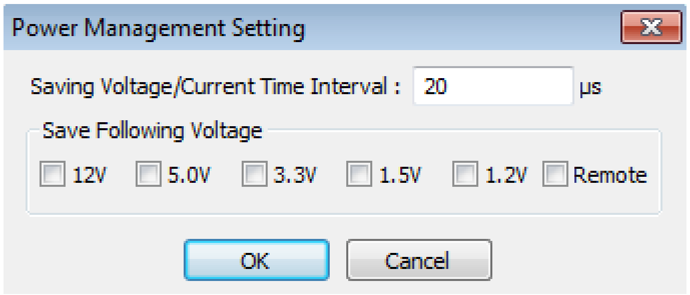
Trace File Name: c:\users\public\documents\lecroy\sas sata pr
☐ Don't upload trace and open upload manager automatically
☐ Auto Run Number of Run : 20

Analyzer Settings
Primitive Response Timeout: 65000 DWORD
HOLD/HOLDA Response Timeout 255
☐ Show XXXX
☐ Disable descrambling
☑ Pack training sequence

ALIGN Transmission Period:
○ 2048 for SSP,256 for STP
● 2049 for SSP,258 for STP

Speed
☑ I1, T1: AutoSpeed
☑ I2, T2: AutoSpeed
☐ I3, T3: AutoSpeed
☐ I4, T4: AutoSpeed

Figure 2.73: Settings Menu -- Power Management



Power Management Setting

Saving Voltage/Current Time Interval : 20 µs

Save Following Voltage

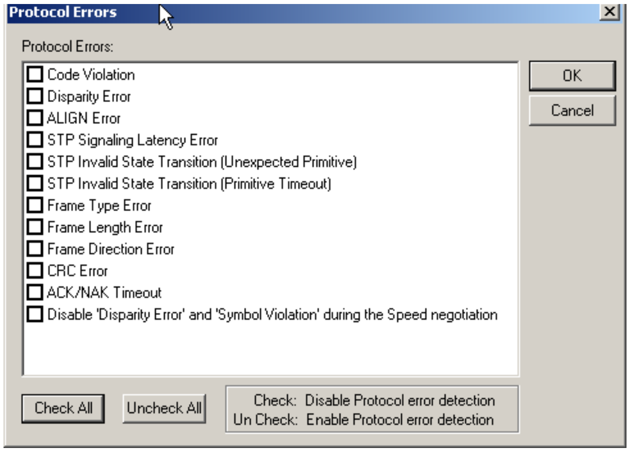
☐ 12V ☐ 5.0V ☐ 3.3V ☐ 1.5V ☐ 1.2V ☐ Remote

Figure 2.74: Protocol Errors Dialog

Set the Saving Voltage/Current Time Interval duration. Check the applicable Voltage value that you want the Analyzer to save. See "Power Tracker View (SATA only)" on page 196 for more information.

Protocol Error Mask

Click the Protocol Error Mask button to open the Protocol Error Mask dialog.



Protocol Errors

Protocol Errors:

☐ Code Violation
☐ Disparity Error
☐ ALIGN Error
☐ STP Signaling Latency Error
☐ STP Invalid State Transition (Unexpected Primitive)
☐ STP Invalid State Transition (Primitive Timeout)
☐ Frame Type Error
☐ Frame Length Error
☐ Frame Direction Error
☐ CRC Error
☐ ACK/NAK Timeout
☐ Disable 'Disparity Error' and 'Symbol Violation' during the Speed negotiation

Check: Disable Protocol error detection
Un Check: Enable Protocol error detection

Figure 2.75: Protocol Errors Dialog

Check the Protocol Errors that you want the Analyzer to ignore.

When "RD Error" and "Code violation Error" are set as trigger events:
"RD Error" or "Code violation Error" can occur right after the OOB sequence.
"RD Error" or "Code violation Error" can occur right after the recovery from the PM state.

These errors are mainly caused by the long synchronization time of the analyzer. If these errors, caused by the Analyzer, become triggers, you cannot detect some other errors that you really need to detect. To NOT detect the above two errors, enable the software setting **Disable 'Disparity Error' and 'Symbol Violation' during Speed negotiation**. After this, the code violation is not triggered during the speed negotiation phase, but is triggered if the violation happens after the speed negotiation phase.

External Trig Out Setting

The Analyzer can send a Low or High external signal anytime a trigger occurs. Select the External Trig Out Setting: High Active, Low Active, or Toggle from High to Low or Low to High once (3.3 V output). Enter the External TrigOut pulse width.

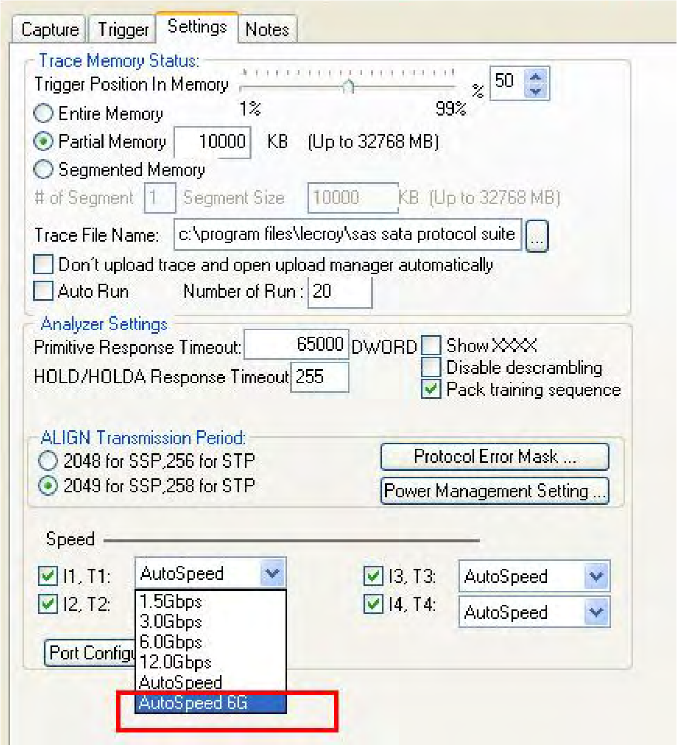
The pulse width is programmable in the software. The Voltage level is 0 to +3.3 Volt. The trigger out is derived by NL17SZ126 buffer. The delay for OOB traffic external trigger out is 190 ns. The delays for non OOB external trigger out are:

- 12 Gbps (12G) ~ 380 ns
- 6 Gbps (6G) ~ 530 ns
- 3 Gbps (3G) ~ 730 ns
- 1.5 Gbps (1.5G) ~ 1020 ns

External Trig In Setting

An external Low or High input signal can cause triggering. Select the External Trig In Setting: High Active, Low Active, or Toggle from High to Low or Low to High once (3.3 V output).

Choose Port Speed


Capture
Trigger
Settings
Notes
Trace Memory Status:
1%
99%
Analyzer Settings
ALIGN Transmission Period:
Protocol Error Mask ...
Power Management Setting ...
Speed
Port Config
1.5Gbps
3.0Gbps
6.0Gbps
12.0Gbps
AutoSpeed
AutoSpeed 6G

Trigger Position In Memory: 50 %
○ Entire Memory
● Partial Memory 10000 KB (Up to 32768 MB)
○ Segmented Memory
# of Segment 1 Segment Size 10000 KB (Up to 32768 MB)
Trace File Name: c:\program files\lecroy\sas sata protocol suite
☐ Don't upload trace and open upload manager automatically
☐ Auto Run Number of Run : 20
Primitive Response Timeout: 65000 DWORD
HOLD/HOLDA Response Timeout 255
☐ Show XXXX
☐ Disable descrambling
☑ Pack training sequence
○ 2048 for SSP,256 for STP
● 2049 for SSP,258 for STP
☑ I1, T1: AutoSpeed
☑ I2, T2:
☑ I3, T3: AutoSpeed
☑ I4, T4: AutoSpeed

Figure 2.76: Speed setting.

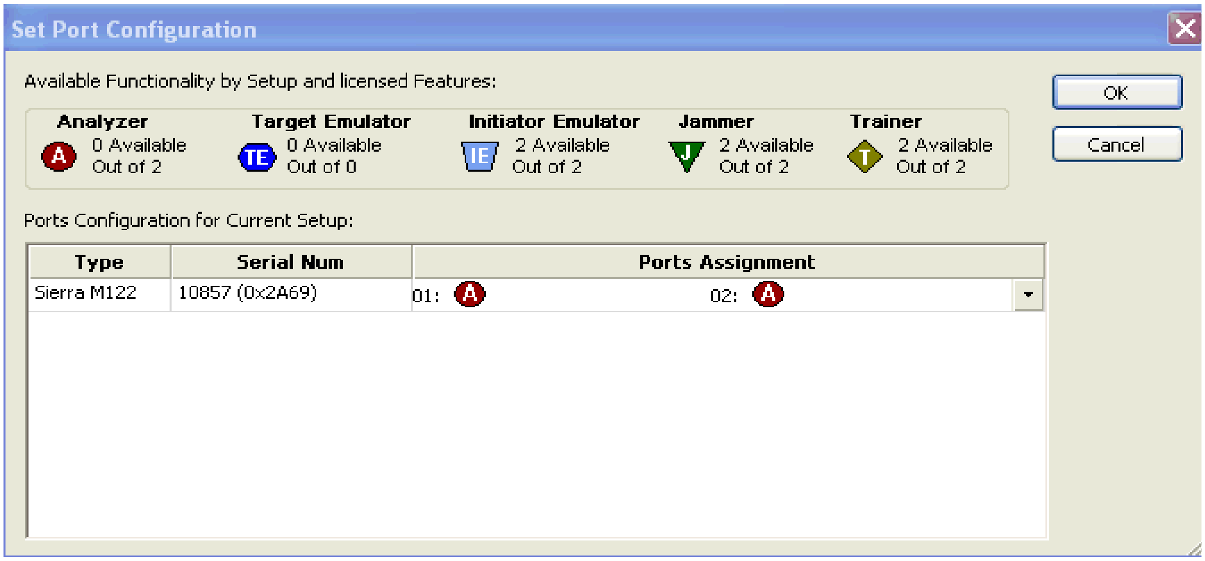
The default speed is Autospeed. You can also select the port speed from the drop-down list: 1.5 Gbps, 3.0 Gbps, 6.0 Gbps or 12.0 Gbps.

By selecting Autospeed 6G, you can limit the port speed to 6 Gbps, to eliminate the possibility of some speed-related errors.

Note: If a Port ID check box has no check, the analyzer does not capture any patterns for that port. The system allocates trace memory for that port to its adjacent port, for example: I1, T1 <-> I2, T2.

Port Configuration

Click the **Port Configuration** button to display the Set Port Configuration dialog.



Available Functionality by Setup and licensed Features:

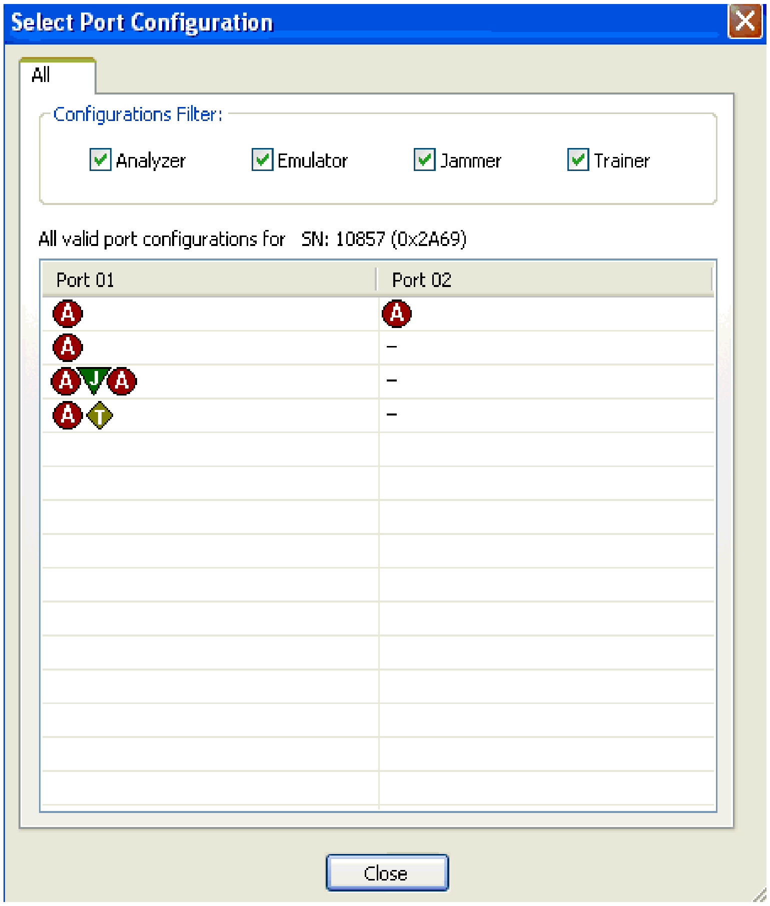
Analyzer	Target Emulator	Initiator Emulator	Jammer	Trainer
A 0 Available Out of 2	TE 0 Available Out of 0	IE 2 Available Out of 2	J 2 Available Out of 2	T 2 Available Out of 2

Ports Configuration for Current Setup:

Type	Serial Num	Ports Assignment
Sierra M122	10857 (0x2A69)	01: A 02: A

Figure 2.77: SAS: Set Port Configuration Dialog.

The dialog shows the current port configuration. To select a port configuration, click the down arrow to display the Select Port Configuration dialog.



☑ Analyzer ☑ Emulator ☑ Jammer ☑ Trainer

All valid port configurations for SN: 10857 (0x2A69)

Port 01	Port 02
A	A
A	–
A J A	–
A T	–

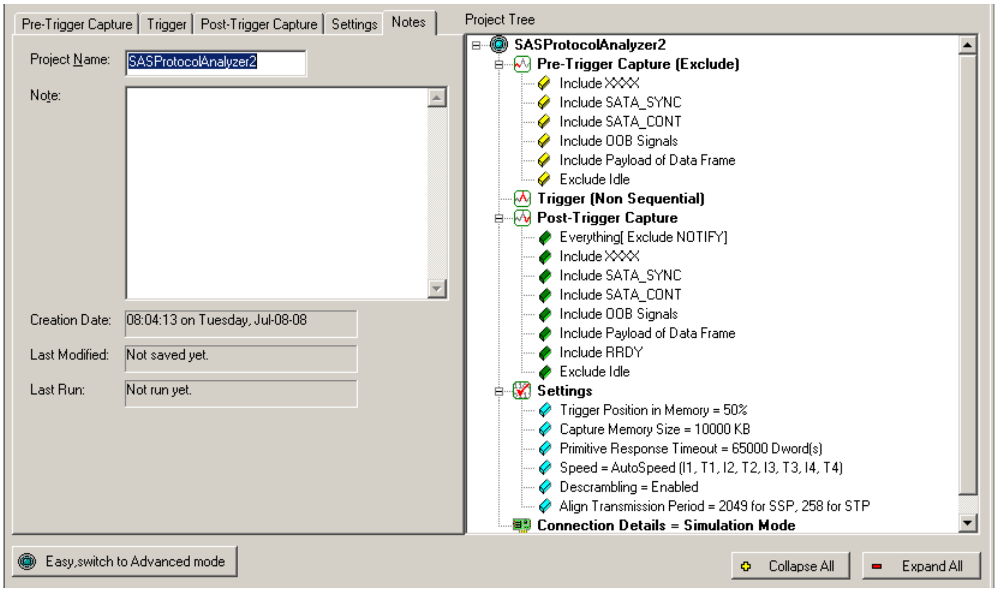
Figure 2.78: SAS: Select Port Configuration Dialog.

Port configuration depends on the application you run. Use the checkboxes at the top to filter the list of port configurations by the required function.

Note: To display the current Port Configuration, click the green button in the lower right corner to display the Port Status window (see “Port Status” on page 235).

2.2.19 Add a Project Note

To enter and save information about the current project, click the **Notes** tab and enter the data about the project.



Project Name: SASProtocolAnalyzer2

Note:

Creation Date: 08:04:13 on Tuesday, Jul-08-08

Last Modified: Not saved yet.

Last Run: Not run yet.

- SASProtocolAnalyzer2
  - Pre-Trigger Capture (Exclude)
    - Include XXXX
    - Include SATA_SYNC
    - Include SATA_CONT
    - Include OOB Signals
    - Include Payload of Data Frame
    - Exclude Idle
  - Trigger (Non Sequential)
  - Post-Trigger Capture
    - Everything[Exclude NOTIFY]
    - Include XXXX
    - Include SATA_SYNC
    - Include SATA_CONT
    - Include OOB Signals
    - Include Payload of Data Frame
    - Include RRDY
    - Exclude Idle
  - Settings
    - Trigger Position in Memory = 50%
    - Capture Memory Size = 10000 KB
    - Primitive Response Timeout = 65000 Dword(s)
    - Speed = AutoSpeed (I1, T1, I2, T2, I3, T3, I4, T4)
    - Descrambling = Enabled
    - Align Transmission Period = 2049 for SSP, 258 for STP
  - Connection Details = Simulation Mode

Figure 2.79: Project Notes Tab,

2.2.20 Advanced Mode (User-Defined)

Advanced Mode expands Analysis capability by allowing you to program complex triggering and data capture projects.

The Advanced Mode is a state machine with up to 23 different states. You can program each state individually to:

- Trigger on a different event or trigger unconditionally.
- Capture Everything, Nothing, or a user-defined pattern.
- Include up to three ELSE IF statements, allowing a jump to any other state based on a user definition.
- Use up to three timers, which you can set to a maximum value of 42949 ms. You can set a timer in the state or continue the timer set in the previous state.
- Output an external trigger High or Low.

Note: In Advanced Mode, events on each link are counted independently. A condition is met if the number of events on a link equals the defined occurrence.

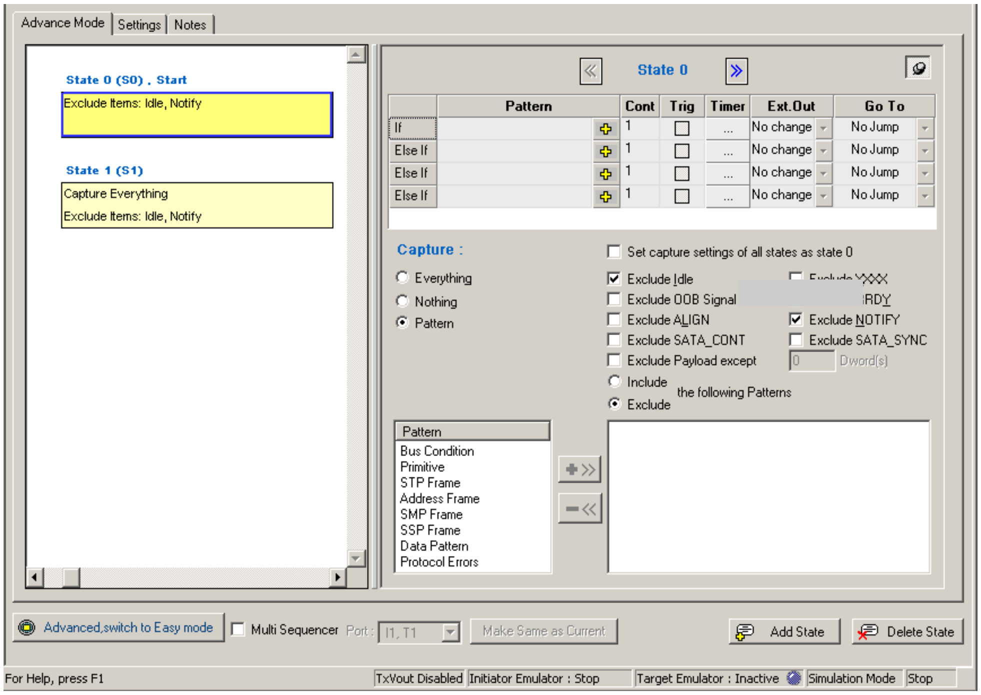
Working in Advanced Mode

To start working in the Advanced Mode, click the **Easy, Switch to Advanced Mode** button in an open Analyzer window.

Easy,switch to Advanced mode

You can:

- ❑ Display the state definition
- ❑ Set Output Trigger level
- ❑ Select up to three timers
- ❑ Define the If condition and up to three Else If conditions
- ❑ Set number of occurrences before trigger
- ❑ Set captured data
- ❑ Set excluded data
- ❑ Go to next state
- ❑ Add state
- ❑ Choose link for Sequencer setup


Advance Mode
Settings
Notes
State 0
Advanced,switch to Easy mode
Make Same as Current
Add State
Delete State
Pattern
Bus Condition
Primitive
STP Frame
Address Frame
SMP Frame
SSP Frame
Data Pattern
Protocol Errors

State 0 (S0) , Start
Exclude Items: Idle, Notify

State 1 (S1)
Capture Everything
Exclude Items: Idle, Notify

	Pattern	Cont	Trig	Timer	Ext.Out	Go To
If		1	☐	...	No change	No Jump
Else If		1	☐	...	No change	No Jump
Else If		1	☐	...	No change	No Jump
Else If		1	☐	...	No change	No Jump

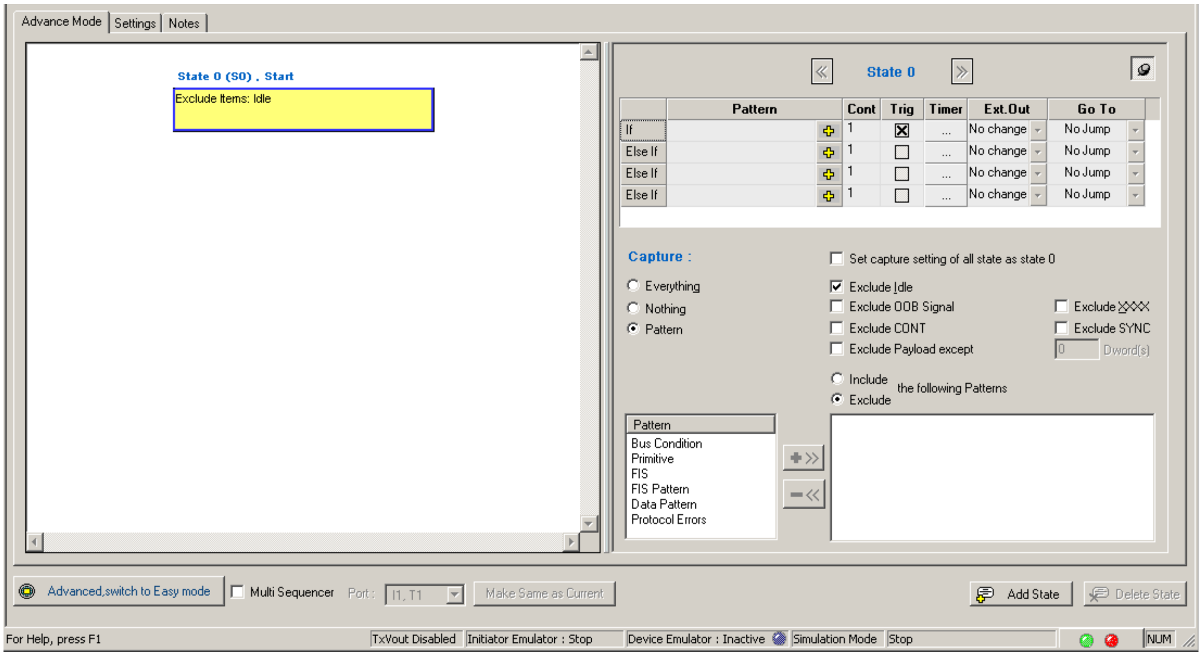
Capture :
○ Everything
○ Nothing
● Pattern

☐ Set capture settings of all states as state 0
☑ Exclude Idle ☐ Exclude XXX
☐ Exclude OOB Signal RDY
☐ Exclude ALIGN ☑ Exclude NOTIFY
☐ Exclude SATA_CONT ☐ Exclude SATA_SYNC
☐ Exclude Payload except 0 Dword(s)
○ Include
● Exclude
the following Patterns

☐ Multi Sequencer Port : I1, T1

For Help, press F1 | TxVout Disabled | Initiator Emulator : Stop | Target Emulator : Inactive | Simulation Mode | Stop

Figure 2.80: SAS: State Programming Dialog


Advance Mode
Settings
Notes
State 0 (S0) . Start
Exclude Items: Idle
State 0
Pattern
Bus Condition
Primitive
FIS
FIS Pattern
Data Pattern
Protocol Errors
Advanced,switch to Easy mode
Multi Sequencer
Port :
I1, T1
Make Same as Current
Add State
Delete State
For Help, press F1
TxVout Disabled
Initiator Emulator : Stop
Device Emulator : Inactive
Simulation Mode
Stop
NUM

	Pattern	Cont	Trig	Timer	Ext.Out	Go To
If		1	☒	...	No change	No Jump
Else If		1	☐	...	No change	No Jump
Else If		1	☐	...	No change	No Jump
Else If		1	☐	...	No change	No Jump

Capture :

○ Everything
○ Nothing
● Pattern

☐ Set capture setting of all state as state 0

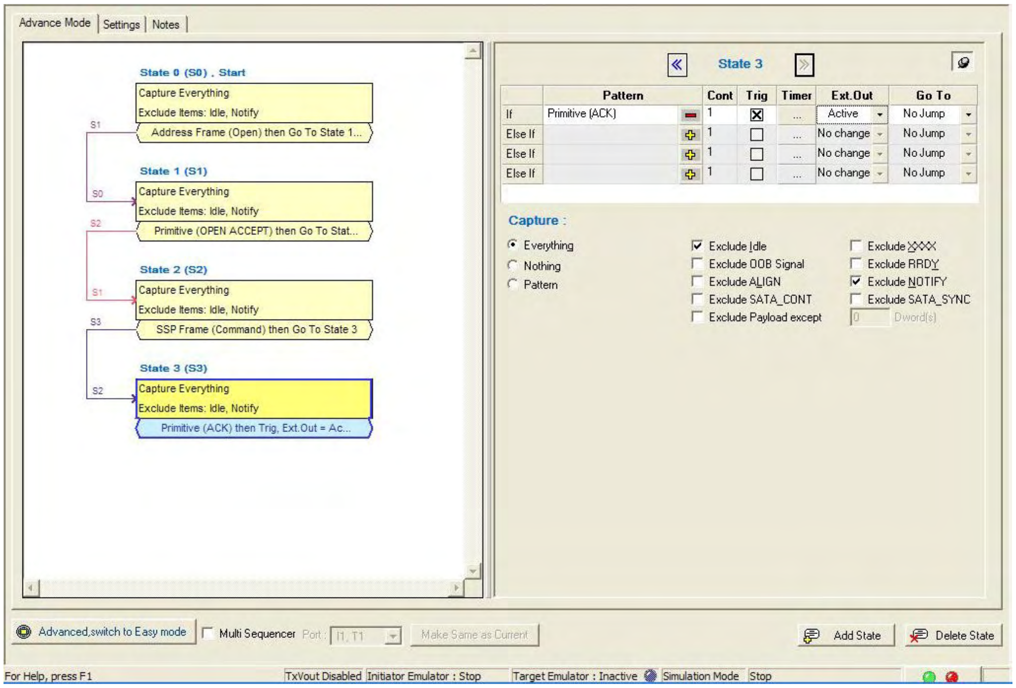
☑ Exclude Idle
☐ Exclude OOB Signal
☐ Exclude CONT
☐ Exclude Payload except
☐ Exclude XXXX
☐ Exclude SYNC
0 Dword(s)

○ Include
● Exclude
the following Patterns

Figure 2.81: SATA: State Programming Dialog

SAS vs. SATA: SATA Dialog removes Exclude ALIGN, Exclude RRDY, and Exclude NOTIFY. SATA Dialog replaces Exclude SATA_CONT with Exclude CONT and Exclude SATA_SYNC with Exclude SYNC.

SATA Dialog has patterns Bus Condition, Primitive, FIS, FIS Pattern, Data Pattern, and Protocol Errors and does not have STP Frame, SMP Frame, STP Frame, or Address Frame.


Advance Mode
Settings
Notes
State 0 (S0) . Start
Capture Everything
Exclude Items: Idle, Notify
Address Frame (Open) then Go To State 1...
S1
State 1 (S1)
Capture Everything
Exclude Items: Idle, Notify
Primitive (OPEN ACCEPT) then Go To Stat...
S0
S2
State 2 (S2)
Capture Everything
Exclude Items: Idle, Notify
SSP Frame (Command) then Go To State 3
S1
S3
State 3 (S3)
Capture Everything
Exclude Items: Idle, Notify
Primitive (ACK) then Trig, Ext.Out = Ac...
S2
State 3
Advanced,switch to Easy mode
Multi Sequencer
Port :
I1, T1
Make Same as Current
Add State
Delete State
For Help, press F1
TxVout Disabled
Initiator Emulator : Stop
Target Emulator : Inactive
Simulation Mode
Stop

	Pattern	Cont	Trig	Timer	Ext.Out	Go To
If	Primitive (ACK)	1	☒	...	Active	No Jump
Else If		1	☐	...	No change	No Jump
Else If		1	☐	...	No change	No Jump
Else If		1	☐	...	No change	No Jump

Capture :

● Everything
○ Nothing
○ Pattern

☑ Exclude Idle
☐ Exclude OOB Signal
☐ Exclude ALIGN
☐ Exclude SATA_CONT
☐ Exclude Payload except
☐ Exclude XXXX
☐ Exclude RRDY
☑ Exclude NOTIFY
☐ Exclude SATA_SYNC
0 Dword(s)

Figure 2.82: SAS: Advanced Trigger with Multiple Branches

State Number for Complex Trigger Sequences

To follow the path of complex trigger sequences, you can display state number.

To see state number, in Packet View right-click a link layer packet, show field, and select state number.

Setting Trigger Conditions

To set the If and Else If trigger condition:

1. Click the **Add Pattern** button for a Pattern field and choose a trigger condition from the drop-down list.

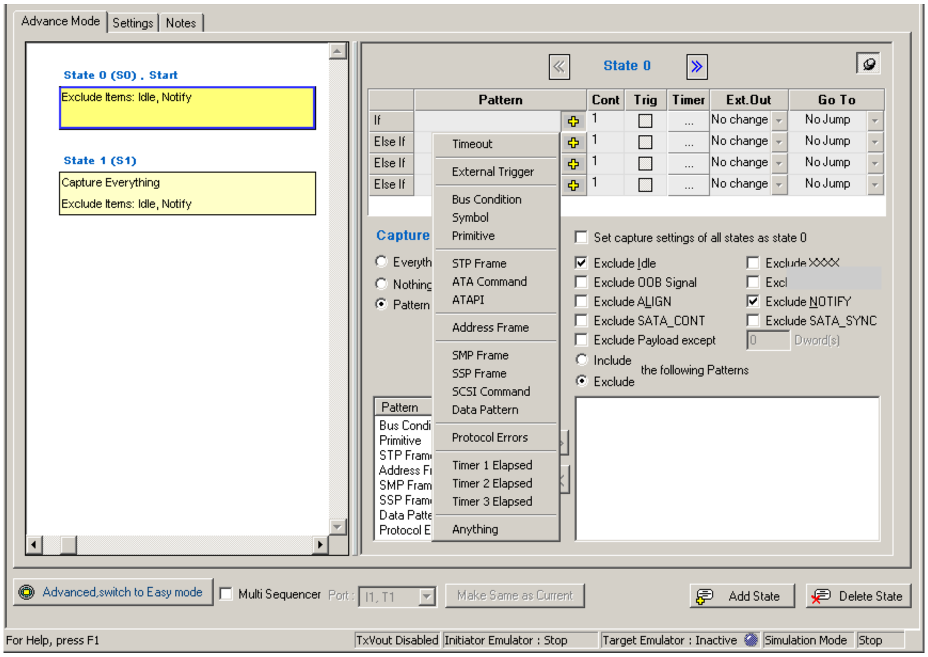

Advance Mode
Settings
Notes
State 0 (S0) . Start
Exclude Items: Idle, Notify
State 1 (S1)
Capture Everything
Exclude Items: Idle, Notify
State 0
Pattern
Cont
Trig
Timer
Ext.Out
Go To
If
Else If
Else If
Else If
1
No change
No Jump
Timeout
External Trigger
Bus Condition
Symbol
Primitive
STP Frame
ATA Command
ATAPI
Address Frame
SMP Frame
SSP Frame
SCSI Command
Data Pattern
Protocol Errors
Timer 1 Elapsed
Timer 2 Elapsed
Timer 3 Elapsed
Anything
Capture
Everyth
Nothing
Pattern
Set capture settings of all states as state 0
Exclude Idle
Exclude OOB Signal
Exclude ALIGN
Exclude SATA_CONT
Exclude Payload except
Dword(s)
Exclude XXXX
Exclude NOTIFY
Exclude SATA_SYNC
Include
Exclude
the following Patterns
Bus Condi
Primitive
STP Fram
Address Fi
SMP Fram
SSP Fram
Data Patte
Protocol E
Advanced,switch to Easy mode
Multi Sequencer
Port :
I1, T1
Make Same as Current
Add State
Delete State
For Help, press F1
TxVout Disabled
Initiator Emulator : Stop
Target Emulator : Inactive
Simulation Mode
Stop

Figure 2.83: SAS: Choosing a Trigger Condition

2. Define each selected pattern in the same way as in Easy Mode, as described starting on page 66. To use a timer, define it first.

Note: You can set a timer for any If or Else If condition.

---

3. Enter a value for the number of occurrences before trigger in the **Cont** field, up to a maximum of 65535 occurrences.
4. Choose a capture option: **Everything, Nothing,** or **Pattern**.
5. If you choose Pattern, you can select patterns for inclusion or exclusion. Clicking the **Pattern** option enables a pattern definition dialog (see Figure 2.84 on page 114).

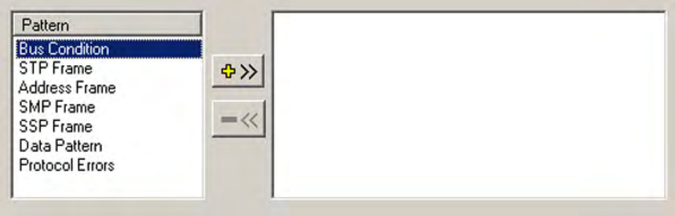


Figure 2.84: SAS: Choosing a Pattern

6. Choose pattern(s) and click the **+>>** button to add them for capture or exclusion. You define each pattern the same way as in Easy mode (see "Defining Patterns" on page 66).
7. For an output trigger, click the down arrow in the **Ext. Out** field and choose an output trigger level. **Note:** Do not use the LOW setting in Advanced Mode.
8. To go to another state, click the down arrow in the **Go To** field and select a state. If no other state has been defined, choose **New State** to add a state.

2.2.21 Multi - Link Triggering

You can set different triggering for each link. To set different trigger conditions for a link, check the **Multi Sequencer** check box and select the link for setup from the Port drop-down list. Clicking the **Make Same as Current** button displays a warning: all sequencers will be changed to have same states as current sequencer. Click **Yes** to do so.

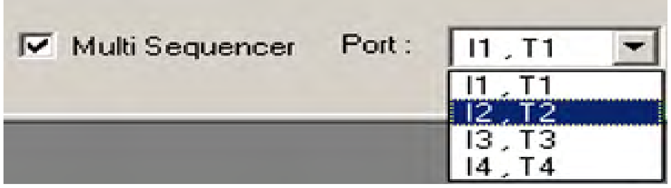
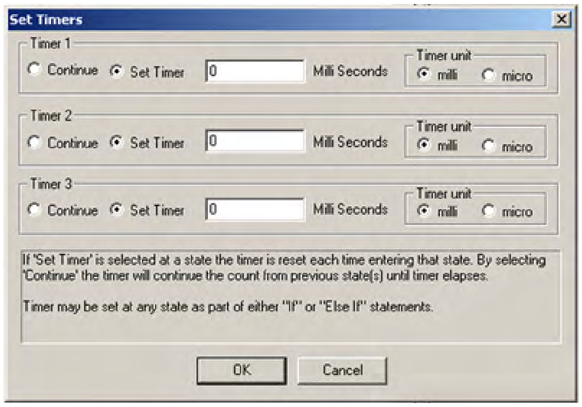


Figure 2.85: SAS: Multi - Link Triggering Setup

2.2.22 Set Timers

You can set and use up to three timers for triggering. You can set each timer for each state, or set it to continue from one set in the previous state. The timer defined for a particular state starts when the system enters that state. You can set a timer for any IF or ELSE IF condition. To set up the timers, click the **ellipses** in the **Timer** field next to the IF or ELSE IF condition in each state and define each of the timers in the Set Timers dialog (see Figure 2.86 on page 115).



Timer 1: ○ Continue ● Set Timer 0 Milli Seconds Timer unit ● milli ○ micro

Timer 2: ○ Continue ● Set Timer 0 Milli Seconds Timer unit ● milli ○ micro

Timer 3: ○ Continue ● Set Timer 0 Milli Seconds Timer unit ● milli ○ micro

If 'Set Timer' is selected at a state the timer is reset each time entering that state. By selecting 'Continue' the timer will continue the count from previous state(s) until timer elapses.

Timer may be set at any state as part of either "If" or "Else If" statements.

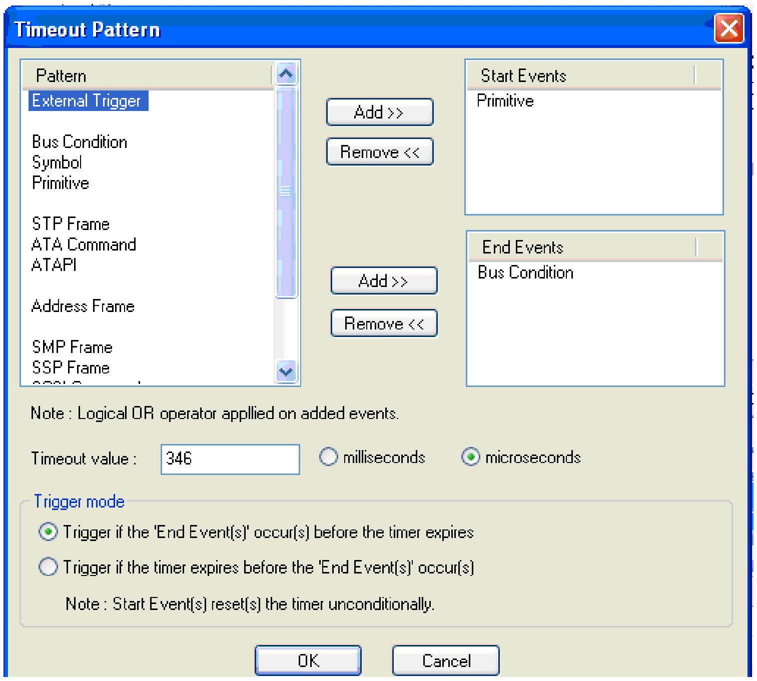
Figure 2.86: Set Timers Dialog

Note: Three timers are available. You have to set and start each timer in order to continue the next timer. For example, you have to start Timer 1, continue it, then set Timer 2 in order to continue it. It will not allow you to continue Timer 2 until you first set it.

2.2.23 Timeout

In the Timeout Pattern dialog (see Figure 2.87 on page 116) you can do the following:

- Set a Timeout.
- Select a Pattern for the Start Event. (Start Event resets the timer.)
- Select a Pattern for the End Event.
- Enter the Timeout Value in milliseconds or microseconds.
- Select a Trigger Mode:
  - If End Event occurs before timer expires.
  - If timer expires before End Event occurs.


Timeout Pattern
Pattern
External Trigger
Bus Condition
Symbol
Primitive
STP Frame
ATA Command
ATAPI
Address Frame
SMP Frame
SSP Frame
Add >>
Remove <<
Start Events
Primitive
Add >>
Remove <<
End Events
Bus Condition
Trigger mode
OK
Cancel

Note : Logical OR operator appllied on added events.

Timeout value : 346 ○ milliseconds ● microseconds

● Trigger if the 'End Event(s)' occur(s) before the timer expires

○ Trigger if the timer expires before the 'End Event(s)' occur(s)

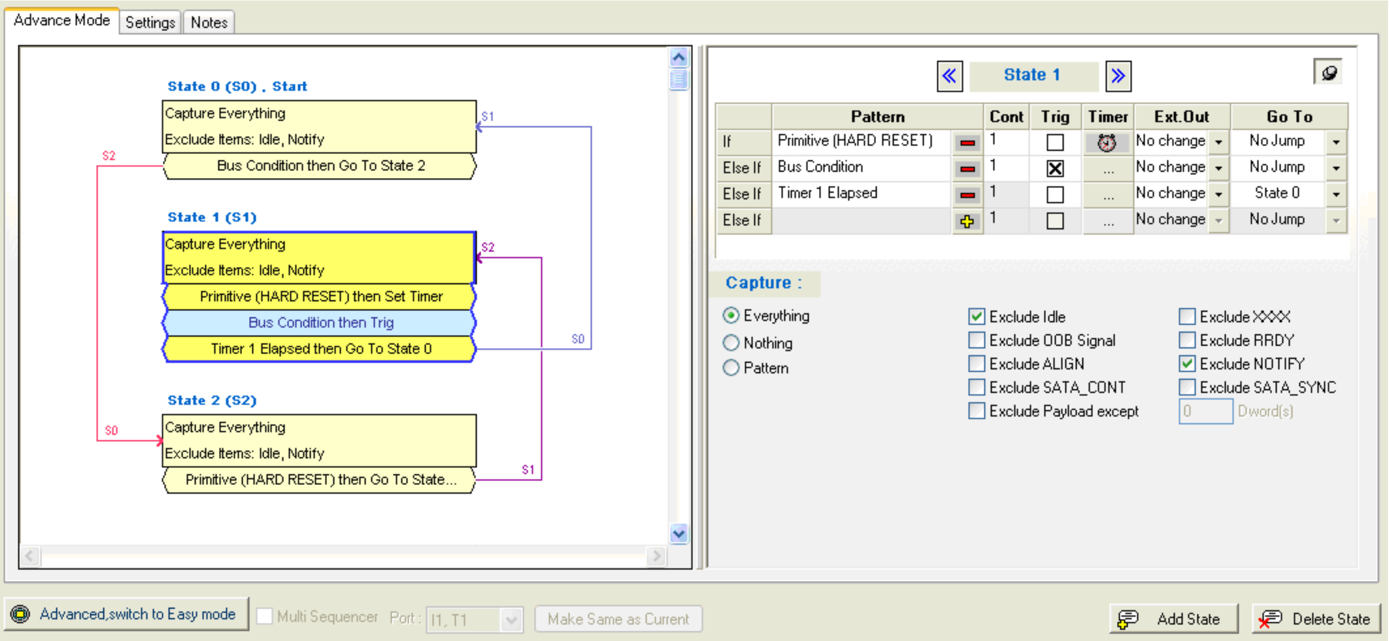
Note : Start Event(s) reset(s) the timer unconditionally.

Figure 2.87: Timeout Dialog

WARNING: In Advanced Mode, Short State Jump Intervals Can Cause Hardware Queue Overflow and Corrupt Frames.

When using Advanced Mode, if too many state jumps occur in a short time, the hardware queue can overflow, which may corrupt frames. For example, an infinite loop can cause many state jumps in a short time. Hardware overflow can occur if interval between state jumps is less than 60 DWORDs.

In Advanced Mode, infinite loops are usually used to check if an event occurs before a timeout. In this case, you can use the Timeout dialog to avoid hardware queue overflow.


Advance Mode
Settings
Notes
Advanced,switch to Easy mode
Multi Sequencer
Port : I1, T1
Make Same as Current
Add State
Delete State

State 0 (S0) , Start
Capture Everything
Exclude Items: Idle, Notify
Bus Condition then Go To State 2

State 1 (S1)
Capture Everything
Exclude Items: Idle, Notify
Primitive (HARD RESET) then Set Timer
Bus Condition then Trig
Timer 1 Elapsed then Go To State 0

State 2 (S2)
Capture Everything
Exclude Items: Idle, Notify
Primitive (HARD RESET) then Go To State...

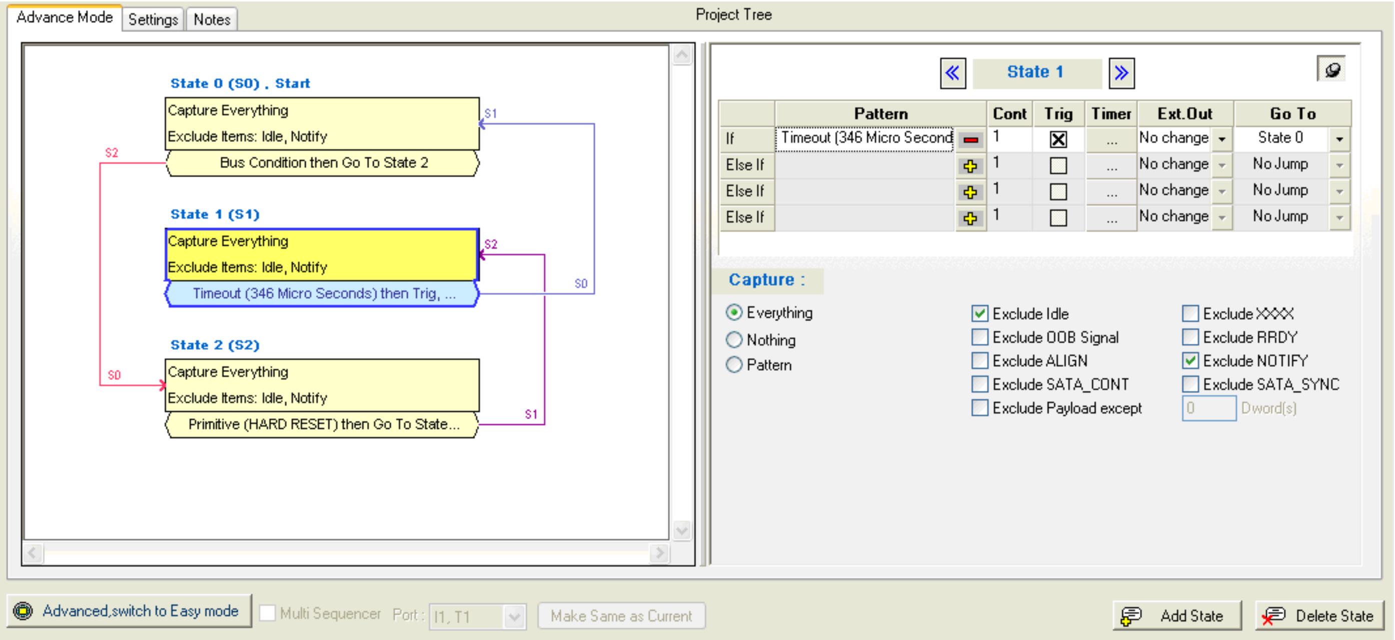
State 1

	Pattern	Cont	Trig	Timer	Ext.Out	Go To
If	Primitive (HARD RESET)	1	☐	⏰	No change	No Jump
Else If	Bus Condition	1	☒	...	No change	No Jump
Else If	Timer 1 Elapsed	1	☐	...	No change	State 0
Else If		1	☐	...	No change	No Jump

Capture :
● Everything
○ Nothing
○ Pattern
☑ Exclude Idle
☐ Exclude OOB Signal
☐ Exclude ALIGN
☐ Exclude SATA_CONT
☐ Exclude Payload except
☐ Exclude XXXX
☐ Exclude RRDY
☑ Exclude NOTIFY
☐ Exclude SATA_SYNC
0 Dword(s)

Figure 2.88: State Machine with Multiple Patterns and Timer Elapse

In Figure 2.88, the port detects HARD_RESET, which starts the Timer. When the timer expires, it jumps to another state. If a trigger occurs between timer start and end, the captured trace will have corrupt frames because of hardware queue overflow.


Advance Mode
Settings
Notes
Project Tree
Advanced,switch to Easy mode
Multi Sequencer
Port : I1, T1
Make Same as Current
Add State
Delete State

State 0 (S0) , Start
Capture Everything
Exclude Items: Idle, Notify
Bus Condition then Go To State 2

State 1 (S1)
Capture Everything
Exclude Items: Idle, Notify
Timeout (346 Micro Seconds) then Trig, ...

State 2 (S2)
Capture Everything
Exclude Items: Idle, Notify
Primitive (HARD RESET) then Go To State...

State 1

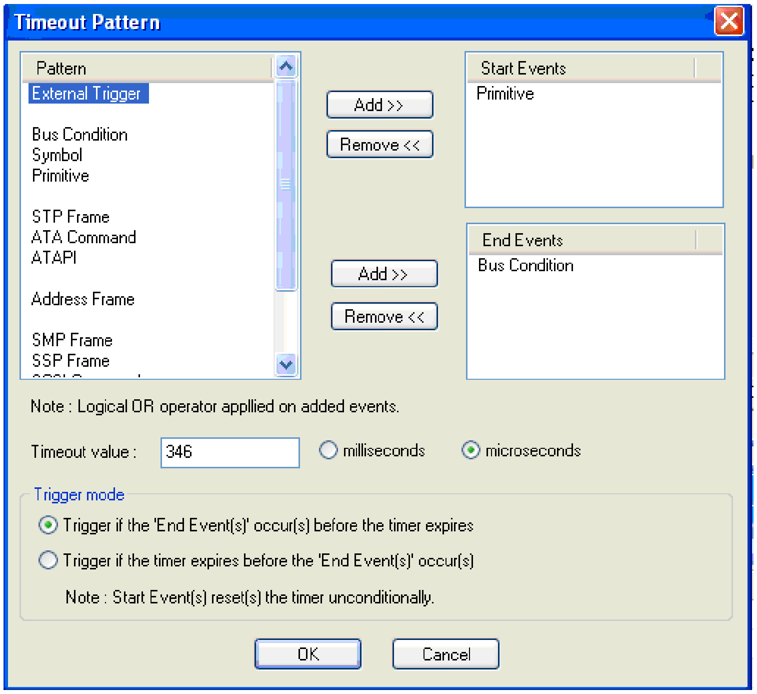
	Pattern	Cont	Trig	Timer	Ext.Out	Go To
If	Timeout (346 Micro Second	1	☒	...	No change	State 0
Else If		1	☐	...	No change	No Jump
Else If		1	☐	...	No change	No Jump
Else If		1	☐	...	No change	No Jump

Capture :
● Everything
○ Nothing
○ Pattern
☑ Exclude Idle
☐ Exclude OOB Signal
☐ Exclude ALIGN
☐ Exclude SATA_CONT
☐ Exclude Payload except
☐ Exclude XXXX
☐ Exclude RRDY
☑ Exclude NOTIFY
☐ Exclude SATA_SYNC
0 Dword(s)

Figure 2.89: State Machine with Timeout Pattern to Replace Timer

To overcome this limitation, use a Timeout Pattern instead of Timer. Figure 2.89 shows the state machine using Timeout instead of Timer.

Figure 2.90 shows the Timeout settings.


Timeout Pattern
Pattern
External Trigger
Bus Condition
Symbol
Primitive
STP Frame
ATA Command
ATAPI
Address Frame
SMP Frame
SSP Frame
Add >>
Remove <<
Add >>
Remove <<
OK
Cancel

Start Events: Primitive

End Events: Bus Condition

Note : Logical OR operator appllied on added events.

Timeout value : 346 ○ milliseconds ● microseconds

Trigger mode

● Trigger if the 'End Event(s)' occur(s) before the timer expires

○ Trigger if the timer expires before the 'End Event(s)' occur(s)

Note : Start Event(s) reset(s) the timer unconditionally.

Figure 2.90: Timeout Settings

Timeout begins when the port detects the Start Event. Timer begins when the port detects the Hard RESET primitive. In the Trigger Mode window, set the Trigger to trigger when the port detects the End Event, before the Timeout occurs. In our example, this is the Bus Condition. Capture begins when the ports detects the Bus Condition before the Timeout occurs. If the port does not detect the Bus Condition until the Timeout occurs, the State Machine in Figure 2.89 on page 117 jumps to State 0.

2.2.24 Useful Key Sequences

The following key sequences are active to assist you in navigating a defined state machine:

Ctrl+a	Add State
Insert	Insert State
Del	Delete State
Ctrl+c/Ctrl+Ins	Copy
Ctrl+v/Shift+Ins	Paste
Up/Down arrow keys	Moves selection between states
Page Up/Page Down	Page Up and Page Down states
Home	Go to first page
End	Go to end page

2.3 Project Settings

Prior to running the Advanced mode project, click the **Settings** tab. The options in the Settings dialog are the same as for the Easy Mode, described starting on page 101.

SAS vs. SATA: For the ALIGN Transmission Period section, SATA Dialog shows options 256 and 258, and does not show 2048 or 2049.

For Speed, SATA Dialog shows H1, D1 to H4, D4 and does not show I1, T1 to I4, T4.
SATA Dialog does not show MUX Setting button.

2.3.1 Notes

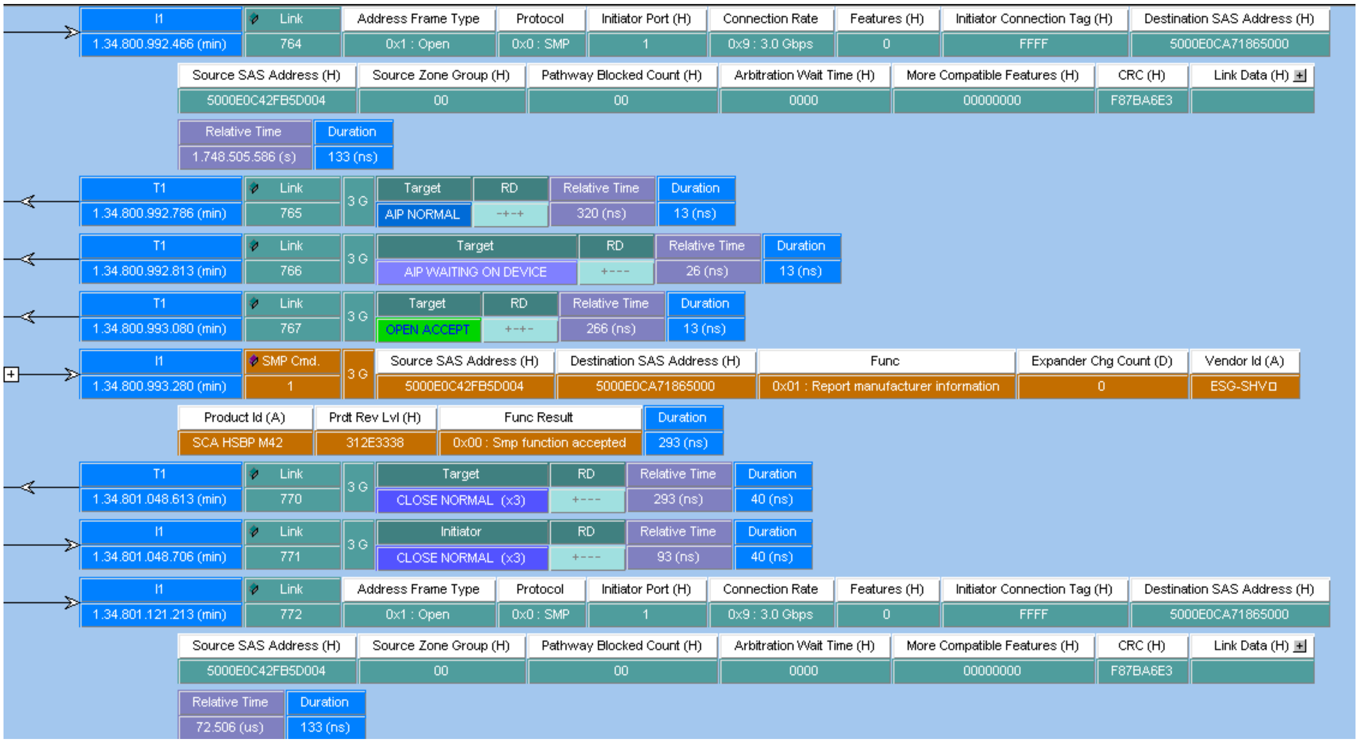
To include some descriptive information about the project, click the **Notes** tab and enter a brief descriptive note (see "Add a Project Note" on page 109).

Chapter 3

Display Manipulation

3.1 Viewer Display

After data is captured (Recorded), the Viewer displays a sample file (**.scs** for SAS and **.sts** for SATA) in Packet View.



I1	Link	Address Frame Type	Protocol	Initiator Port (H)	Connection Rate	Features (H)	Initiator Connection Tag (H)	Destination SAS Address (H)
1.34.800.992.466 (min)	764	0x1 : Open	0x0 : SMP	1	0x9 : 3.0 Gbps	0	FFFF	5000E0CA71865000

Source SAS Address (H)	Source Zone Group (H)	Pathway Blocked Count (H)	Arbitration Wait Time (H)	More Compatible Features (H)	CRC (H)	Link Data (H) ⊞
5000E0C42FB5D004	00	00	0000	00000000	F87BA6E3	

Relative Time	Duration
1.748.505.586 (s)	133 (ns)

T1	Link	3 G	Target	RD	Relative Time	Duration
1.34.800.992.786 (min)	765		AIP NORMAL	-+-+	320 (ns)	13 (ns)

T1	Link	3 G	Target	RD	Relative Time	Duration
1.34.800.992.813 (min)	766		AIP WAITING ON DEVICE	+---	26 (ns)	13 (ns)

T1	Link	3 G	Target	RD	Relative Time	Duration
1.34.800.993.080 (min)	767		OPEN ACCEPT	+-+-	266 (ns)	13 (ns)

I1	SMP Cmd.	3 G	Source SAS Address (H)	Destination SAS Address (H)	Func	Expander Chg Count (D)	Vendor Id (A)
1.34.800.993.280 (min)	1		5000E0C42FB5D004	5000E0CA71865000	0x01 : Report manufacturer information	0	ESG-SHV□

Product Id (A)	Prdt Rev Lvl (H)	Func Result	Duration
SCA HSBP M42	312E3338	0x00 : Smp function accepted	293 (ns)

T1	Link	3 G	Target	RD	Relative Time	Duration
1.34.801.048.613 (min)	770		CLOSE NORMAL (x3)	+---	293 (ns)	40 (ns)

I1	Link	3 G	Initiator	RD	Relative Time	Duration
1.34.801.048.706 (min)	771		CLOSE NORMAL (x3)	+---	93 (ns)	40 (ns)

I1	Link	Address Frame Type	Protocol	Initiator Port (H)	Connection Rate	Features (H)	Initiator Connection Tag (H)	Destination SAS Address (H)
1.34.801.121.213 (min)	772	0x1 : Open	0x0 : SMP	1	0x9 : 3.0 Gbps	0	FFFF	5000E0CA71865000

Source SAS Address (H)	Source Zone Group (H)	Pathway Blocked Count (H)	Arbitration Wait Time (H)	More Compatible Features (H)	CRC (H)	Link Data (H) ⊞
5000E0C42FB5D004	00	00	0000	00000000	F87BA6E3	

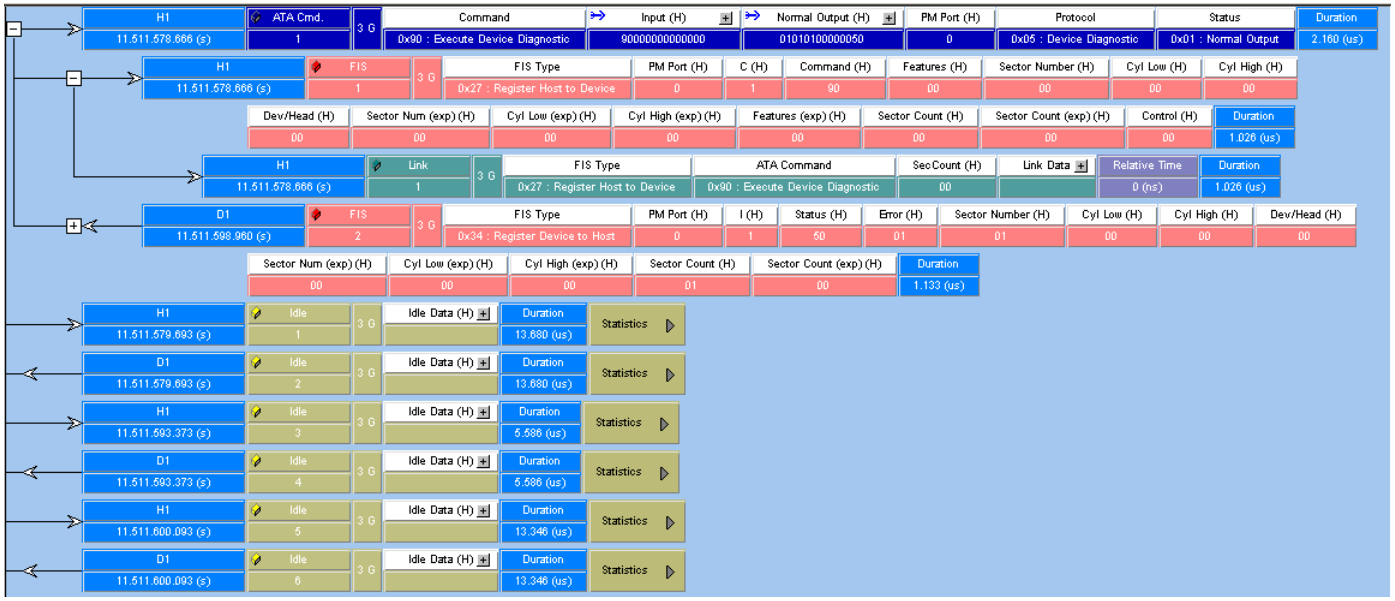
Relative Time	Duration
72.506 (us)	133 (ns)

Figure 3.1: SAS: Packet View of .scs Sample File.

3.1.1 Scrolling

On Packet View / Spreadsheet View / Column View / Text View, with frame A selected:

- ☐ If you scroll with the mouse wheel or go up / down with keyboard arrow button, the software will scroll the view but the frame A remains selected.
- ☐ If you scroll with mouse wheel or go up / down with keyboard arrow button while pressing the Shift button, software will scroll to the next frame like B, C, or D.



H1	ATA Cmd.	3 G	Command	Input (H)	Normal Output (H)	PM Port (H)	Protocol	Status	Duration
11.511.578.666 (s)	1		0x90 : Execute Device Diagnostic	90000000000000	01010100000050	0	0x05 : Device Diagnostic	0x01 : Normal Output	2.160 (us)

H1	FIS	3 G	FIS Type	PM Port (H)	C (H)	Command (H)	Features (H)	Sector Number (H)	Cyl Low (H)	Cyl High (H)
11.511.578.666 (s)	1		0x27 : Register Host to Device	0	1	90	00	00	00	00

Dev/Head (H)	Sector Num (exp) (H)	Cyl Low (exp) (H)	Cyl High (exp) (H)	Features (exp) (H)	Sector Count (H)	Sector Count (exp) (H)	Control (H)	Duration
00	00	00	00	00	00	00	00	1.026 (us)

H1	Link	3 G	FIS Type	ATA Command	SecCount (H)	Link Data	Relative Time	Duration
11.511.578.666 (s)	1		0x27 : Register Host to Device	0x90 : Execute Device Diagnostic	00		0 (ns)	1.026 (us)

D1	FIS	3 G	FIS Type	PM Port (H)	I (H)	Status (H)	Error (H)	Sector Number (H)	Cyl Low (H)	Cyl High (H)	Dev/Head (H)
11.511.598.960 (s)	2		0x34 : Register Device to Host	0	1	50	01	01	00	00	00

Sector Num (exp) (H)	Cyl Low (exp) (H)	Cyl High (exp) (H)	Sector Count (H)	Sector Count (exp) (H)	Duration
00	00	00	01	00	1.133 (us)

H1	Idle	3 G	Idle Data (H)	Duration	Statistics
11.511.579.693 (s)	1			13.680 (us)	

D1	Idle	3 G	Idle Data (H)	Duration	Statistics
11.511.579.693 (s)	2			13.680 (us)	

H1	Idle	3 G	Idle Data (H)	Duration	Statistics
11.511.593.373 (s)	3			5.586 (us)	

D1	Idle	3 G	Idle Data (H)	Duration	Statistics
11.511.593.373 (s)	4			5.586 (us)	

H1	Idle	3 G	Idle Data (H)	Duration	Statistics
11.511.600.093 (s)	5			13.346 (us)	

D1	Idle	3 G	Idle Data (H)	Duration	Statistics
11.511.600.093 (s)	6			13.346 (us)	

Figure 3.2: SATA: Packet View of .sts Sample File.

3.1.2 Quick View

Quick View is enabled as the default setting in **Preferences > Trace Viewer** tab. Quick View allows full access to the whole trace more quickly, especially when using a Gigabit Ethernet connection. However, the trace is NOT written to the host machine's hard drive. To save the trace, you must manually click **Save**.

If you uncheck **Quick View** in the **Preferences > Trace Viewer** tab to disable Quick View, the trace loads more slowly, but is automatically saved to the host machine's hard drive. When Quick View is disabled, the Viewer displays successive parts of trace data as they upload. As soon as a trace part uploads, it is available in all trace views.

If you only need quick successive traces, and do not need to save them, keep the default setting to enable Quick View.

If you need to save all captured traces, unchecking the Quick View setting loads traces faster, especially for larger traces and slower connections than Gigabit Ethernet.

To refresh the viewer display with more uploaded data, scroll to the end of the trace, using scroll bars, page down, arrow down, or CTRL-End. Newly uploaded data then appears there.

Note: High-level decoding and statistics are available only after the whole trace has uploaded.

The software automatically switches to full trace view after trace uploading finishes.

Note: Users must press **CTRL Home** to go to the beginning of an uploaded trace, and **CTRL End** to go to the end of an uploaded trace.

3.1.3 Using the Viewer Display

To configure the data viewer display, use the toolbars. You can display the same data in:

- Packet view
- Spreadsheet view
- Column view, with transactions grouped for each active port
- Text view, with transactions grouped for each active port
- Waveform view
- Frame Inspector view
- Histogram view
- Bus Utilization view
- Data Report
- Statistical Report view
- Power Tracker View (SATA)

To change the view type when opening a sample, change the default workspace or save options in the **Preferences** dialog.

To toggle among open windows, use **CTRL - TAB**.
To reverse toggle order, use **CTRL - SHIFT - TAB**.

To make a frame a trigger pattern, in Packet View, right-click any frame, select **Add to Trigger**, and add the pattern to **DataPatternCapture**.

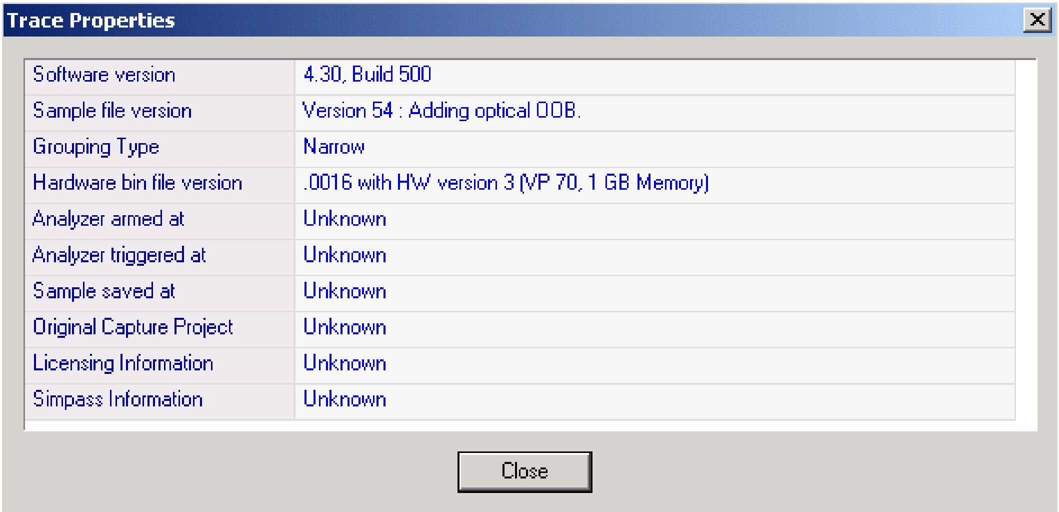
Viewer Display enables you to also perform the following:

- Decode Assignments (Refer to Decoding Assignments on page 125 for more details.)
- Compare Two Data Payloads (Refer to Compare Two Data Payloads on page 190 for more details.)
- Run Verification Scripts (Refer to Running Verification Script Engine (VSE) on page 198 for more details.)

3.2 Trace Properties

You can view the Trace Properties from the File menu. Click **File > Trace Properties**, the Trace Properties dialog displays with the following information (see Figure 3.3 on page 124):

- Software version
- Sample file version
- Grouping Type
- Hardware bin file version
- Analyzer armed at
- Analyzer triggered at
- Sample saved at
- Original Capture Project: **Open** displays the project settings used to capture the sample.
- Licensing Information
- Simpass Information


Trace Properties
Close

Software version	4.30, Build 500
Sample file version	Version 54 : Adding optical OOB.
Grouping Type	Narrow
Hardware bin file version	.0016 with HW version 3 (VP 70, 1 GB Memory)
Analyzer armed at	Unknown
Analyzer triggered at	Unknown
Sample saved at	Unknown
Original Capture Project	Unknown
Licensing Information	Unknown
Simpass Information	Unknown

Figure 3.3: Trace Properties Dialog.

3.3 Analysis

The Analysis menu options allows you to see the trace in various views and switch views.

3.3.1 Show Analysis Toolbar

To display the capture in any of the other available views you can make the selection on the View Type toolbar as shown below or select the menu option under Analysis as shown in Figure 3.5 on page 125.

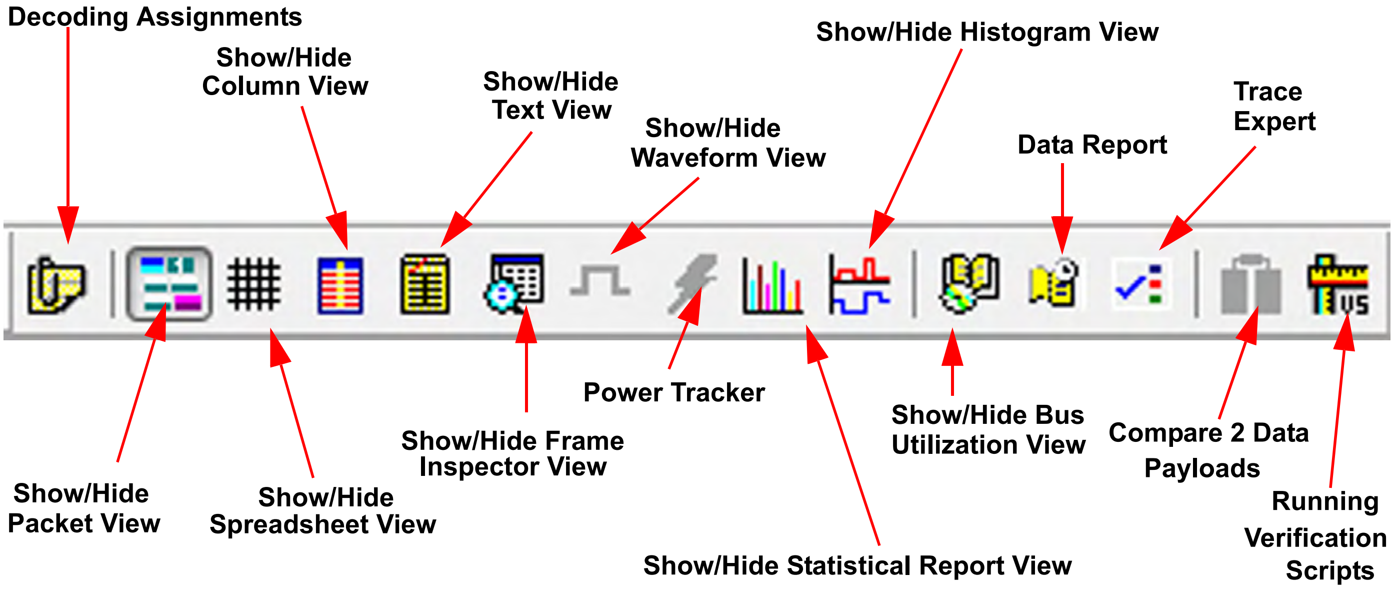

Decoding Assignments
Show/Hide Column View
Show/Hide Text View
Show/Hide Waveform View
Show/Hide Histogram View
Data Report
Trace Expert
Show/Hide Packet View
Show/Hide Spreadsheet View
Show/Hide Frame Inspector View
Power Tracker
Show/Hide Statistical Report View
Show/Hide Bus Utilization View
Compare 2 Data Payloads
Running Verification Scripts

Figure 3.4: View Type Toolbar.

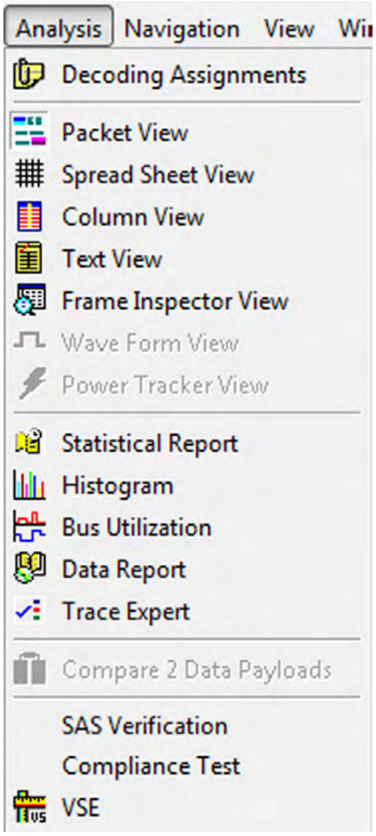
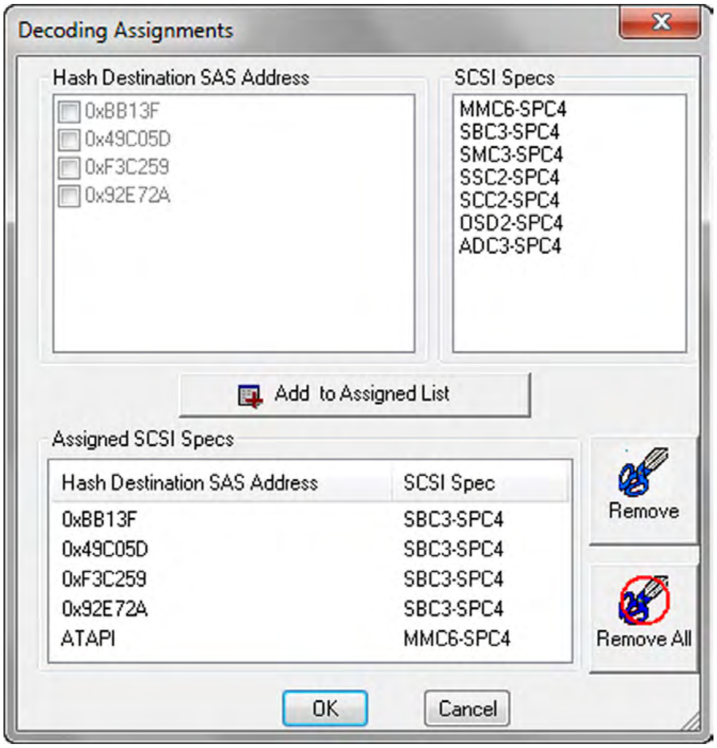

Analysis
Navigation
View
Wi
Decoding Assignments
Packet View
Spread Sheet View
Column View
Text View
Frame Inspector View
Wave Form View
Power Tracker View
Statistical Report
Histogram
Bus Utilization
Data Report
Trace Expert
Compare 2 Data Payloads
SAS Verification
Compliance Test
VSE

Figure 3.5: SAS/SATA Analysis Menu.

3.3.2 Decoding Assignments

The SAS/SATA Protocol Suite is designed to automatically assign SCSI decoding to a trace by using SBC3-SPC4 for SSP based transactions and MMC6-SPC4 for ATAPI/STP based transactions. To view the current decoding assignment for devices in the trace, click on the **Decoding Assignments** icon. See Figure 3.5 and Figure 3.6.



Hash Destination SAS Address

- ☐ 0xBB13F
- ☐ 0x49C05D
- ☐ 0xF3C259
- ☐ 0x92E72A

SCSI Specs

MMC6-SPC4
SBC3-SPC4
SMC3-SPC4
SSC2-SPC4
SCC2-SPC4
OSD2-SPC4
ADC3-SPC4

Assigned SCSI Specs

Hash Destination SAS Address	SCSI Spec
0xBB13F	SBC3-SPC4
0x49C05D	SBC3-SPC4
0xF3C259	SBC3-SPC4
0x92E72A	SBC3-SPC4
ATAPI	MMC6-SPC4

Figure 3.6: Decoding Assignments

In the **Decoding Assignments** window, the hashed address for all SCSI devices detected in the trace will appear in the **Hash Destination SAS Address** list. The supported specifications appear in the window on the right labeled **SCSI Specs**. The **Assigned SCSI Specs** scroll list displays the current assignment for each hashed address detected in the trace. This scroll list allows users to manually change the decoding assignment post capture. This may be necessary if the trace contains SAS traffic that is not SCSI Block Command 3 (SBC3) based, such as SAS tape or multimedia devices (rare).

If for any reason, the **Assigned SCSI Specs** list is displaying an incorrect spec for an individual device, select the Hash Address within this list and click the **Remove** button. To assign a different specification to the same device, reselect the device hashed address in the upper **Hash Destination SAS Address** window. Then select the correct specification in the SCSI Spec(s) window. Click the **Add to Assigned List** button to assign the individual decode. It's only possible to assign one SCSI Spec to a given hash address. Decoding changes should appear immediately but It's necessary to save the trace to keep any decoding changes.

In general SATA devices do not require manual decode assignment. Most SATA-based HDD/SSD devices use the ATA/ATAPI command set and are automatically decoded using the MMC6-SPC4 specification. Some removable SATA multimedia devices utilize the PACKET feature set (also known as ATAPI devices). These ATAPI based devices use a subset of the SCSI command set by default will be decoded using the Multi-Media Commands - 6 (MMC6-SPC4). Some SATA multimedia devices may alternately use the SCSI Streaming Command set (SSC2-SPC4). For these devices it may be necessary to manually assign the decoding to the SSC2-SPC4 spec. See Figure 3.7.

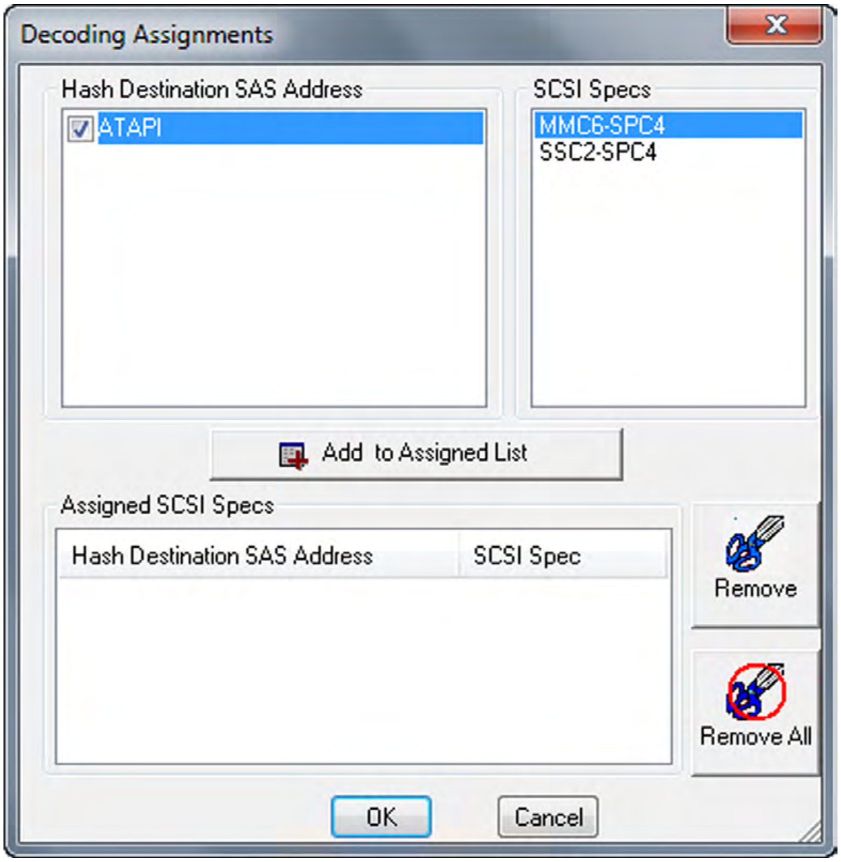
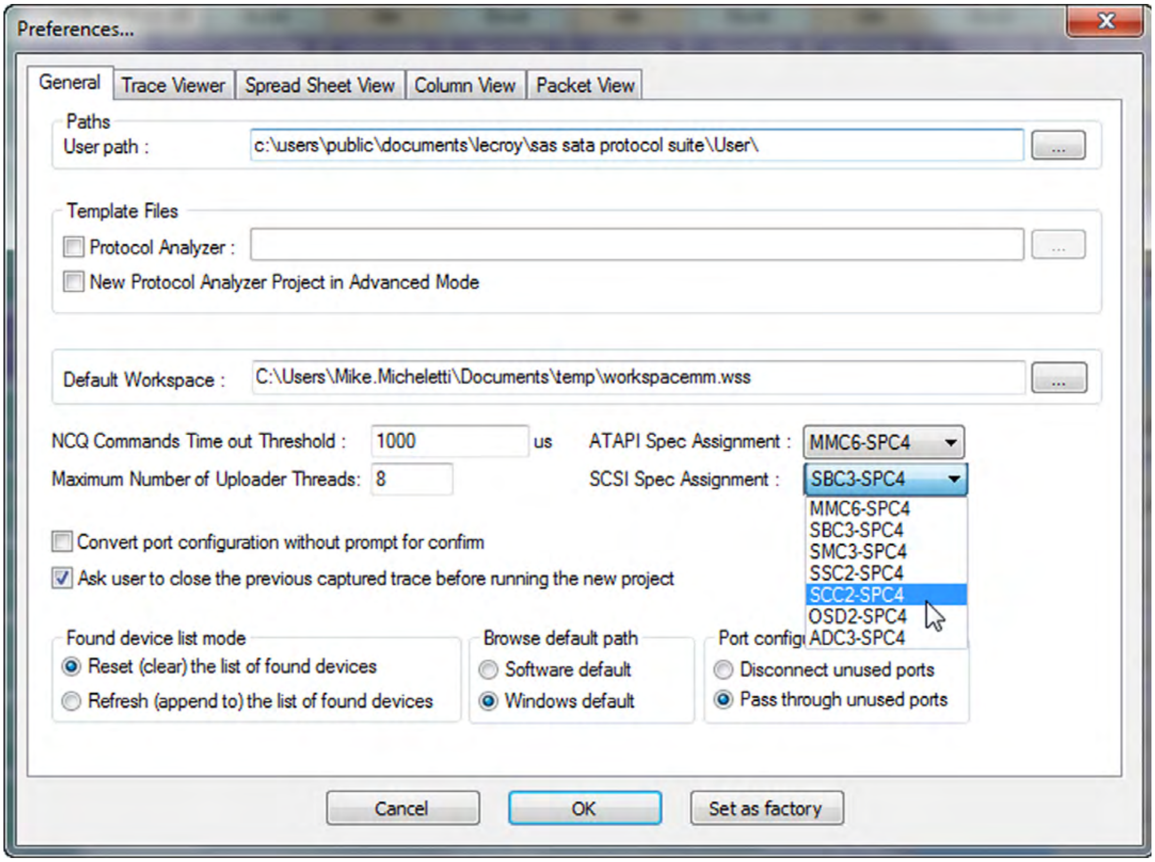

Decoding Assignments
Hash Destination SAS Address
☑ ATAPI
SCSI Specs
MMC6-SPC4
SSC2-SPC4
Add to Assigned List
Assigned SCSI Specs
Hash Destination SAS Address
SCSI Spec
Remove
Remove All
OK
Cancel

Figure 3.7: Decoding Assignments SATA

To make changes to the default decoding, use the Preferences window to assign the specific SCSI specification for all future traces. By changing the default decoding in the Preferences window, the Search and Hide options will also reflect the correct decoded fields. See Figure 3.8.


Preferences...
General
Trace Viewer
Spread Sheet View
Column View
Packet View
Paths
Template Files
MMC6-SPC4
SBC3-SPC4
SMC3-SPC4
SSC2-SPC4
SCC2-SPC4
OSD2-SPC4
ADC3-SPC4
Cancel
OK
Set as factory

User path : c:\users\public\documents\lecroy\sas sata protocol suite\User\

☐ Protocol Analyzer :

☐ New Protocol Analyzer Project in Advanced Mode

Default Workspace : C:\Users\Mike.Micheletti\Documents\temp\workspacemm.wss

NCQ Commands Time out Threshold : 1000 us

ATAPI Spec Assignment : MMC6-SPC4

Maximum Number of Uploader Threads: 8

SCSI Spec Assignment : SBC3-SPC4

☐ Convert port configuration without prompt for confirm

☑ Ask user to close the previous captured trace before running the new project

Found device list mode
● Reset (clear) the list of found devices
○ Refresh (append to) the list of found devices

Browse default path
○ Software default
● Windows default

Port config
○ Disconnect unused ports
● Pass through unused ports

Figure 3.8: Preferences Window

If a specific SCSI Spec does not appear in the SCSI Specs window, it may not be supported by the current release of the SAS / SATA Protocol Suite. Contact Teledyne LeCroy Technical Support to request additional decode development.

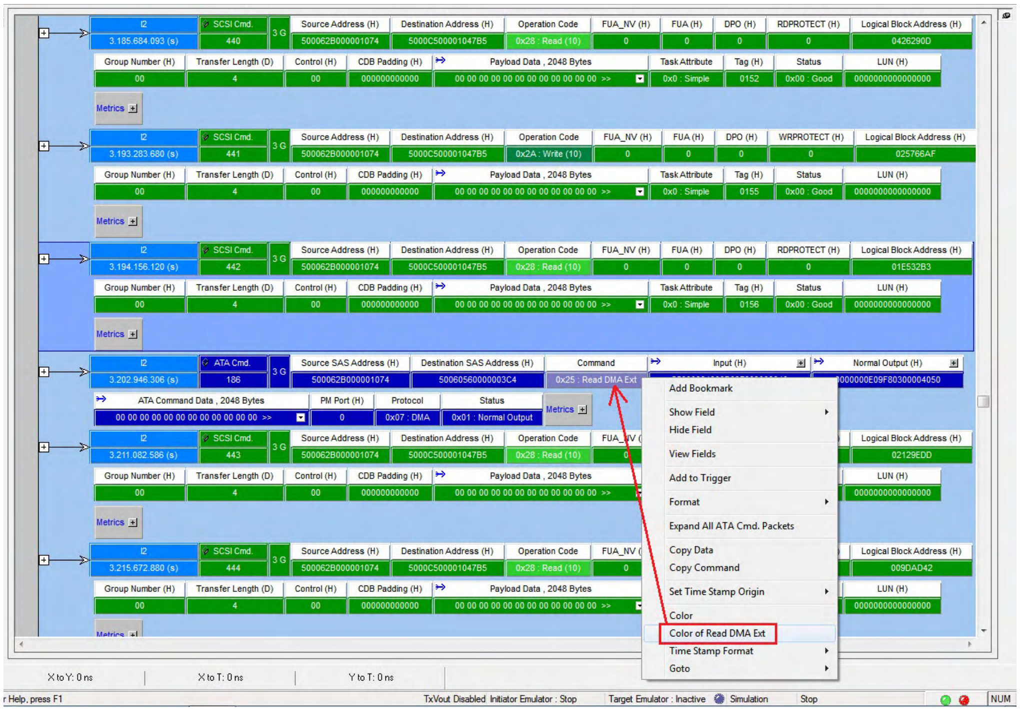
3.3.3 Packet View

After you select a view, it appears in a separate window. To increase the new window display size, select **Analysis > Packet View** or, click the **Show/Hide Packet View** button.

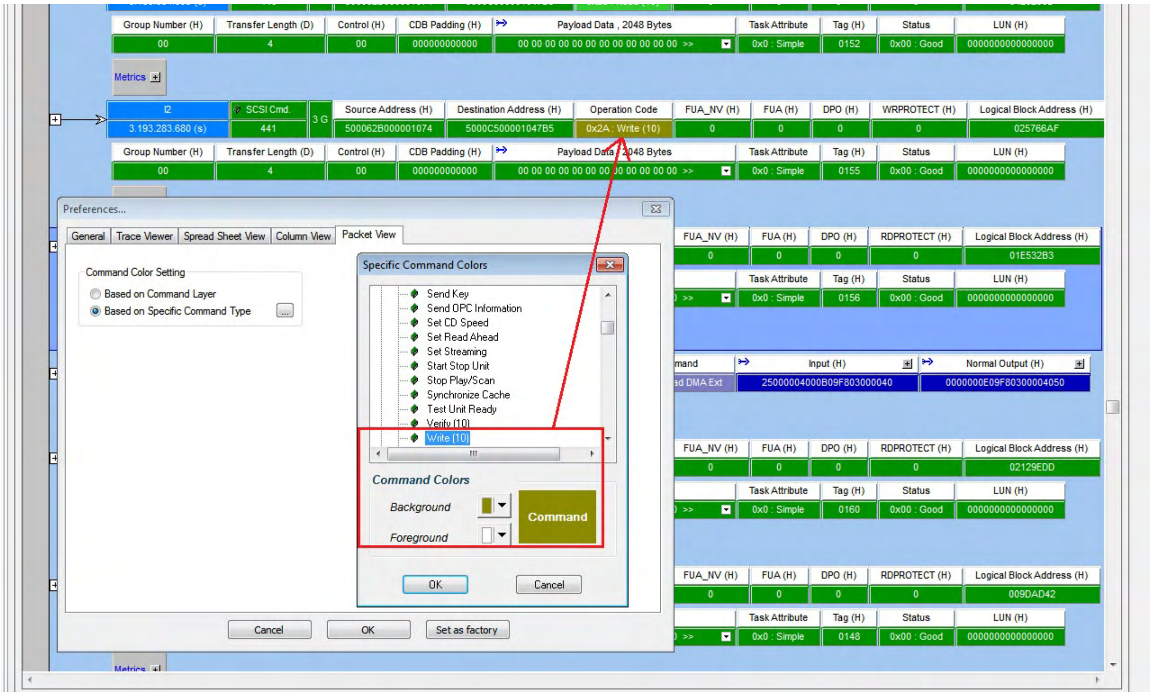
When scrolling through either display using the scroll bar, the corresponding display in the other view scrolls with it.

You can rearrange the tiling by clicking **Window** and choosing **Vertical** or **Horizontal** tiling.

You can customize the color of any operation code field using either of the following two methods:


Add Bookmark
Show Field
Hide Field
View Fields
Add to Trigger
Format
Expand All ATA Cmd. Packets
Copy Data
Copy Command
Set Time Stamp Origin
Color
Color of Read DMA Ext
Time Stamp Format
Goto

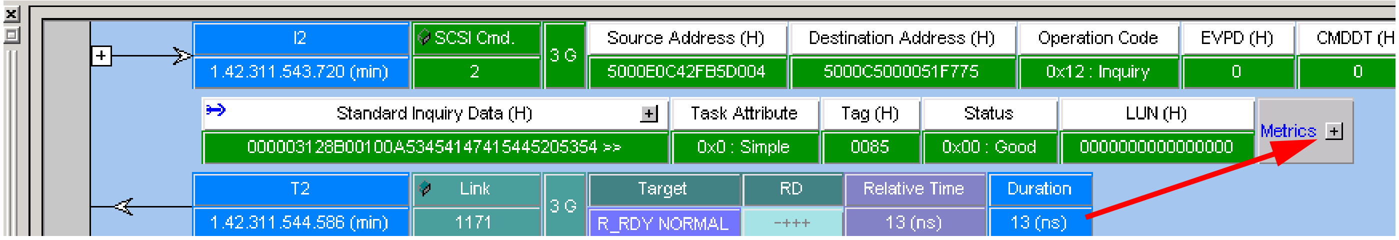
1. Right-click on any command field in the trace. Select "Color of ..." option to set the color for the selected operation code field.


Preferences...
General
Trace Viewer
Spread Sheet View
Column View
Packet View
Command Color Setting
Based on Command Layer
Based on Specific Command Type
Specific Command Colors
Send Key
Send OPC Information
Set CD Speed
Set Read Ahead
Set Streaming
Start Stop Unit
Stop Play/Scan
Synchronize Cache
Test Unit Ready
Verify (10)
Write (10)
Command Colors
Background
Foreground
Command
OK
Cancel
Cancel
OK
Set as factory

2. In the Preferences window, select the Packet View tab. select the "Based on Specific Command Type" option. In the commands list, search for any command that you want, and change the background and foreground colors.

Packet View Metrics

The Metrics feature provides quick access to additional information about the packet data. Click the Metrics + icon as shown in Figure 3.9 to display the details.



I2 1.42.311.543.720 (min)
SCSI Cmd. 2
3 G
Source Address (H) 5000E0C42FB5D004
Destination Address (H) 5000C5000051F775
Operation Code 0x12 : Inquiry
EVPD (H) 0
CMDDT (H 0
Standard Inquiry Data (H) 000003128B00100A534541474154452053 54 >>
Task Attribute 0x0 : Simple
Tag (H) 0085
Status 0x00 : Good
LUN (H) 0000000000000000
Metrics
T2 1.42.311.544.586 (min)
Link 1171
3 G
Target R_RDY NORMAL
RD -+++
Relative Time 13 (ns)
Duration 13 (ns)

Figure 3.9: Packet View Metrics.

The following additional packet information is displayed when the Metrics field is expanded. Refer to Figure 3.10 on page 130.

Performance Reference Definitions

Trp. No. - Number of Transports

The total number of transports that compose this exchange.

Resp. Time - Response Time

The time taken to transmit this command on the link(s) from the beginning of the first frame in the command to the end of the last frame in the command.

Pld. Bytes - Payload Bytes

The number of payload bytes this operation transferred.

Latency Time

The time measured from the transmission of the command to the first data transmitted for this IO operation.

Data-Stat. Time - Data to Status Time

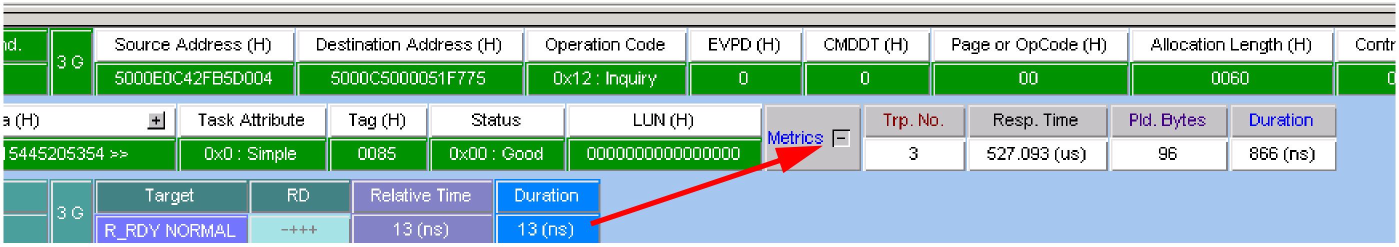
The time between the end of data transmission for this command and the Status frame.

Thrpt MB/s- Data Throughput

The payload divided by response time expressed in MB per second.

Duration

The time taken from the first DWord to the last DWord in a line.



nd.
3 G
Source Address (H) 5000E0C42FB5D004
Destination Address (H) 5000C5000051F775
Operation Code 0x12 : Inquiry
EVPD (H) 0
CMDDT (H) 0
Page or OpCode (H) 00
Allocation Length (H) 0060
Contr 0
a (H) 5445205354 >>
Task Attribute 0x0 : Simple
Tag (H) 0085
Status 0x00 : Good
LUN (H) 0000000000000000
Metrics
Trp. No. 3
Resp. Time 527.093 (us)
Pld. Bytes 96
Duration 866 (ns)
3 G
Target R_RDY NORMAL
RD -+++
Relative Time 13 (ns)
Duration 13 (ns)

Figure 3.10: Packet View Metrics Expanded.

Copying Packets from a Trace to a Host Emulator Script

This check mark in the illustration below shows packet (s) selected to copy. You can copy packet(s) from a trace and paste it into a host emulator script. That is why you can only mark packets that we support in emulator and host side packets. You can also mark multiple packets by left-clicking and moving the mouse over multiple packets and then right-click to select them, and paste them in an emulator script.

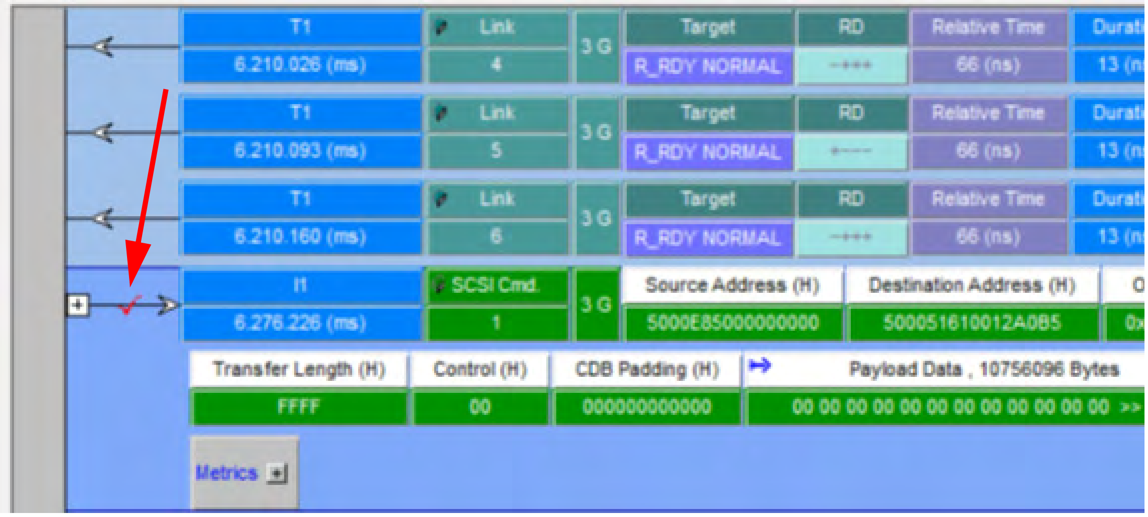

T1
6.210.026 (ms)
Link
4
3 G
Target
R_RDY NORMAL
RD
-+++
Relative Time
66 (ns)
Durat
13 (n
T1
6.210.093 (ms)
Link
5
3 G
Target
R_RDY NORMAL
RD
+---
Relative Time
66 (ns)
Durat
13 (n
T1
6.210.160 (ms)
Link
6
3 G
Target
R_RDY NORMAL
RD
-+++
Relative Time
66 (ns)
Durat
13 (n
I1
6.276.226 (ms)
SCSI Cmd.
1
3 G
Source Address (H)
5000E85000000000
Destination Address (H)
500051610012A0B5
Transfer Length (H)
FFFF
Control (H)
00
CDB Padding (H)
000000000000
Payload Data , 10756096 Bytes
00 00 00 00 00 00 00 00 00 00 00 00 >>
Metrics

Figure 3.11: Packets Selected to Copy.

This is applicable only when using M6-4 or M6-2 as only they support emulation.

Device Sleep (DevSlp)

The Device Sleep status is displayed throughout the trace by right-clicking and selecting **Device Sleep** in Packet View.

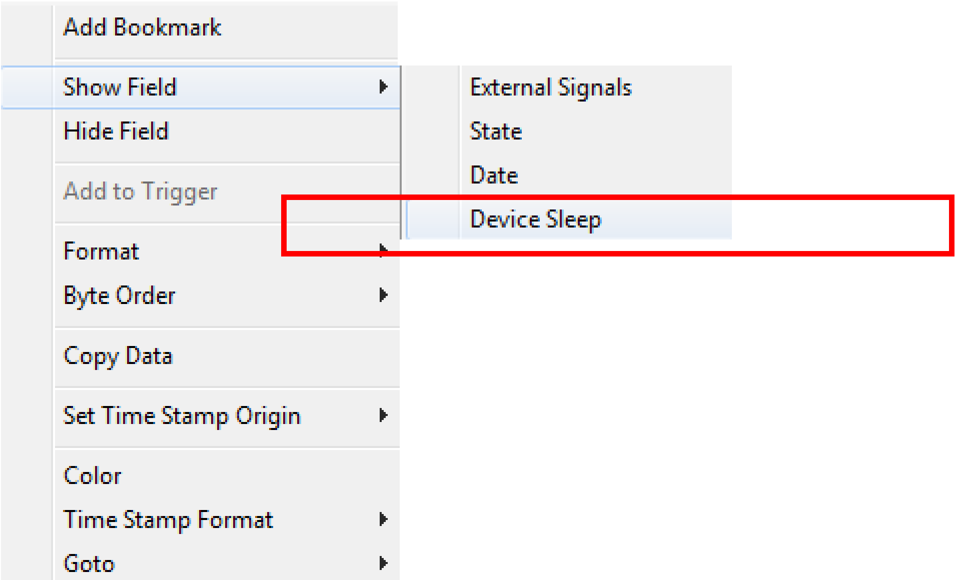
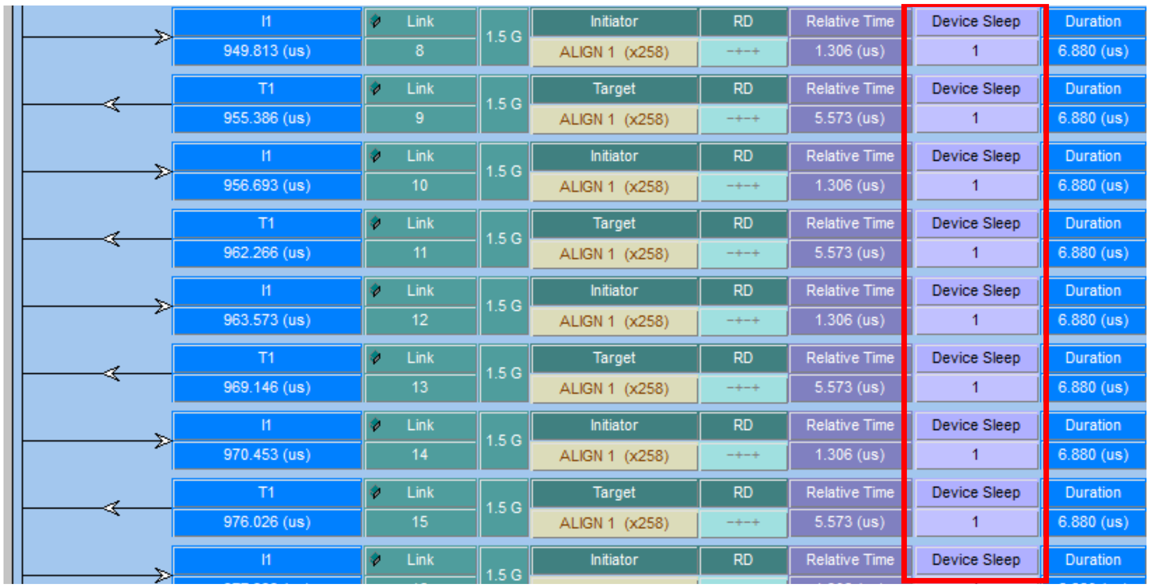

Add Bookmark
Show Field
Hide Field
Add to Trigger
Format
Byte Order
Copy Data
Set Time Stamp Origin
Color
Time Stamp Format
Goto
External Signals
State
Date
Device Sleep

Figure 3.12: Right-click **Device Sleep** Menu.

The trace now displays the Device Sleep fields of all the packets (see Figure 3.13 on page 132). Current measurement accuracy is +/- 10mA for 5V and lower signals, and +/-

100mA for 12V. Voltage measurement accuracy is +/- 100mV for 5V and lower and +/- 150mV for 12V.



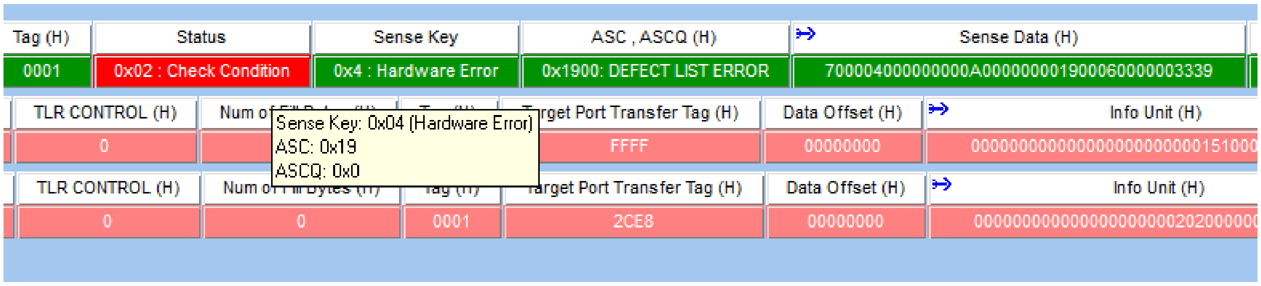
I1	Link	1.5 G	Initiator	RD	Relative Time	Device Sleep	Duration
949.813 (us)	8		ALIGN 1 (x258)	-+-+	1.306 (us)	1	6.880 (us)
T1	Link	1.5 G	Target	RD	Relative Time	Device Sleep	Duration
955.386 (us)	9		ALIGN 1 (x258)	-+-+	5.573 (us)	1	6.880 (us)
I1	Link	1.5 G	Initiator	RD	Relative Time	Device Sleep	Duration
956.693 (us)	10		ALIGN 1 (x258)	-+-+	1.306 (us)	1	6.880 (us)
T1	Link	1.5 G	Target	RD	Relative Time	Device Sleep	Duration
962.266 (us)	11		ALIGN 1 (x258)	-+-+	5.573 (us)	1	6.880 (us)
I1	Link	1.5 G	Initiator	RD	Relative Time	Device Sleep	Duration
963.573 (us)	12		ALIGN 1 (x258)	-+-+	1.306 (us)	1	6.880 (us)
T1	Link	1.5 G	Target	RD	Relative Time	Device Sleep	Duration
969.146 (us)	13		ALIGN 1 (x258)	-+-+	5.573 (us)	1	6.880 (us)
I1	Link	1.5 G	Initiator	RD	Relative Time	Device Sleep	Duration
970.453 (us)	14		ALIGN 1 (x258)	-+-+	1.306 (us)	1	6.880 (us)
T1	Link	1.5 G	Target	RD	Relative Time	Device Sleep	Duration
976.026 (us)	15		ALIGN 1 (x258)	-+-+	5.573 (us)	1	6.880 (us)
I1	Link	1.5 G	Initiator	RD	Relative Time	Device Sleep	Duration

Figure 3.13: Device Sleep Fields.

Viewing Check Condition Sense Data

When a Check Condition error occurs, you can view decode data from it.

This info is shown in Packet View. Under Transport layer, expand Info Unit, then expand Sense Data. In Column View, check the “show Field View in Column View” check box in SW settings, then display Field View while column View is open.



Tag (H)	Status	Sense Key	ASC , ASCQ (H)	Sense Data (H)
0001	0x02 : Check Condition	0x4 : Hardware Error	0x1900: DEFECT LIST ERROR	7000040000000000A000000001900060000000003339

TLR CONTROL (H)	Num o	T	Target Port Transfer Tag (H)	Data Offset (H)	Info Unit (H)
0			FFFF	00000000	000000000000000000000000151000

Sense Key: 0x04 (Hardware Error)
ASC: 0x19
ASCQ: 0x0

TLR CONTROL (H)	Num of Fill Bytes (H)	Tag (H)	Target Port Transfer Tag (H)	Data Offset (H)	Info Unit (H)
0	0	0001	2CE8	00000000	000000000000000000000202000000

Figure 3.14: Check Condition Data.

1. Open Packet View.

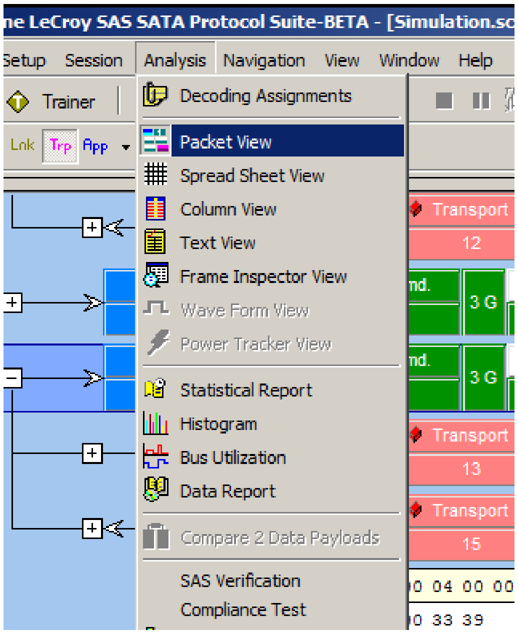

ne LeCroy SAS SATA Protocol Suite-BETA - [Simulation.sc
Setup
Session
Analysis
Navigation
View
Window
Help
Trainer
Lnk
Trp
App
Decoding Assignments
Packet View
Spread Sheet View
Column View
Text View
Frame Inspector View
Wave Form View
Power Tracker View
Statistical Report
Histogram
Bus Utilization
Data Report
Compare 2 Data Payloads
SAS Verification
Compliance Test
Transport
12
nd.
3 G
nd.
3 G
Transport
13
Transport
15
0 04 00 00
0 33 39

Figure 3.15: Packet view.

2. Show Transport layer.

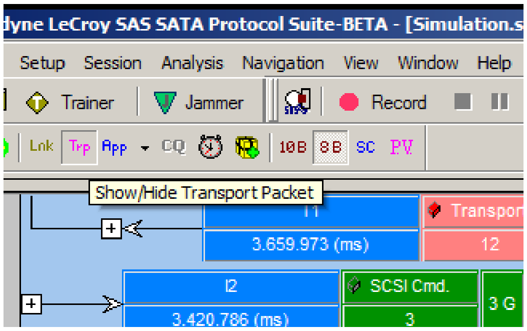
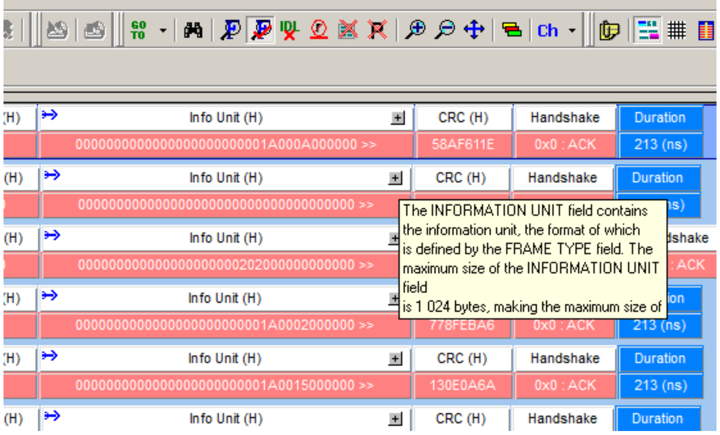

dyne LeCroy SAS SATA Protocol Suite-BETA - [Simulation.s
Setup
Session
Analysis
Navigation
View
Window
Help
Trainer
Jammer
Record
Lnk
Trp
App
CQ
10B
8B
SC
PV
Show/Hide Transport Packet
11
3.659.973 (ms)
Transpor
12
I2
SCSI Cmd.
3 G
3.420.786 (ms)
3

Figure 3.16: Transport layer.

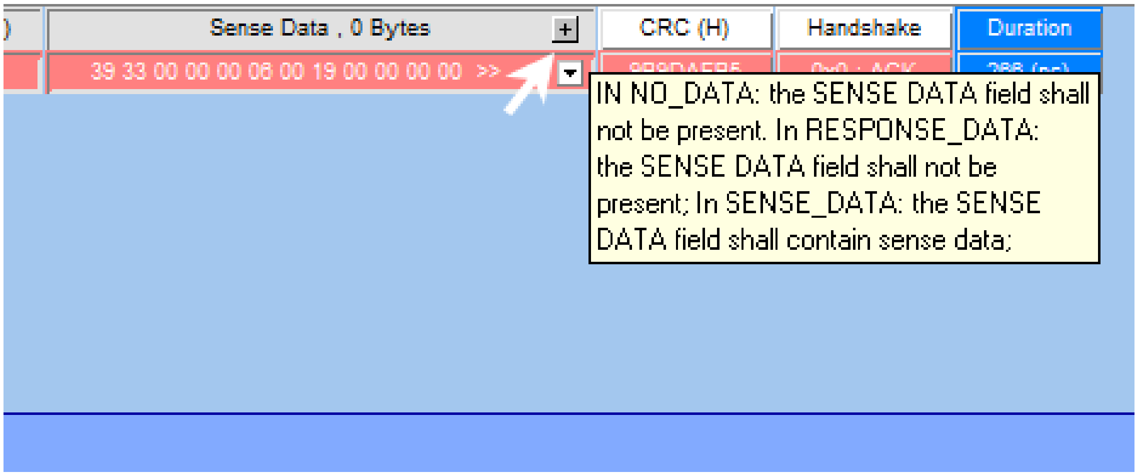
3. Expand the Information Unit.


GO TO
Ch
(H)
Info Unit (H)
CRC (H)
Handshake
Duration
000000000000000000000001A000A000000 >>
58AF611E
0x0 : ACK
213 (ns)
(H)
Info Unit (H)
CRC (H)
Handshake
Duration
0000000000000000000000000000000000 >>
ns)
(H)
Info Unit (H)
dshake
00000000000000000000002020000000000000 >>
: ACK
(H)
Info Unit (H)
ion
000000000000000000000001A0002000000 >>
778FEBA6
0x0 : ACK
213 (ns)
(H)
Info Unit (H)
CRC (H)
Handshake
Duration
000000000000000000000001A0015000000 >>
130E0A6A
0x0 : ACK
213 (ns)
(H)
Info Unit (H)
CRC (H)
Handshake
Duration

The INFORMATION UNIT field contains the information unit, the format of which is defined by the FRAME TYPE field. The maximum size of the INFORMATION UNIT field
is 1 024 bytes, making the maximum size of

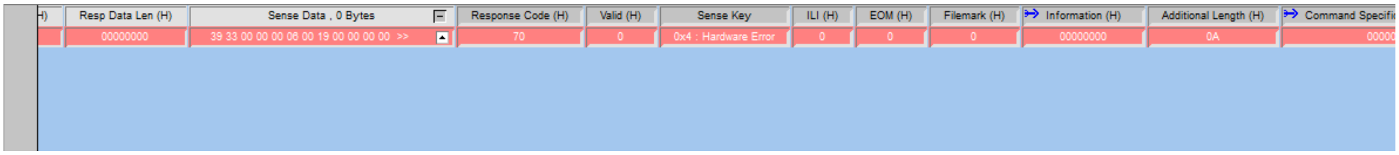
Figure 3.17: Information unit.

4. Expand Sense Data. The hidden fields are revealed.


Sense Data , 0 Bytes
CRC (H)
Handshake
Duration
39 33 00 00 00 06 00 19 00 00 00 00 >>

IN NO_DATA: the SENSE DATA field shall not be present. In RESPONSE_DATA: the SENSE DATA field shall not be present; In SENSE_DATA: the SENSE DATA field shall contain sense data;

Figure 3.18: Sense data.



Resp Data Len (H)	Sense Data , 0 Bytes	Response Code (H)	Valid (H)	Sense Key	ILI (H)	EOM (H)	Filemark (H)	Information (H)	Additional Length (H)	Command Specifi
00000000	39 33 00 00 00 06 00 19 00 00 00 00 >>	70	0	0x4 : Hardware Error	0	0	0	00000000	0A	0000

Figure 3.19: Sense data expanded.

Go to Command / Go to Response

The Go to Command / Go to Response feature can be used to scroll through a large data packet to find SCSI commands and responses.

To use the Go to Command / Go to Response feature, open a trace with a data packet and "Right Click" on the Data section of the packet (TimeStamp = 35.965 us). See Figure 3.20 on page 134.

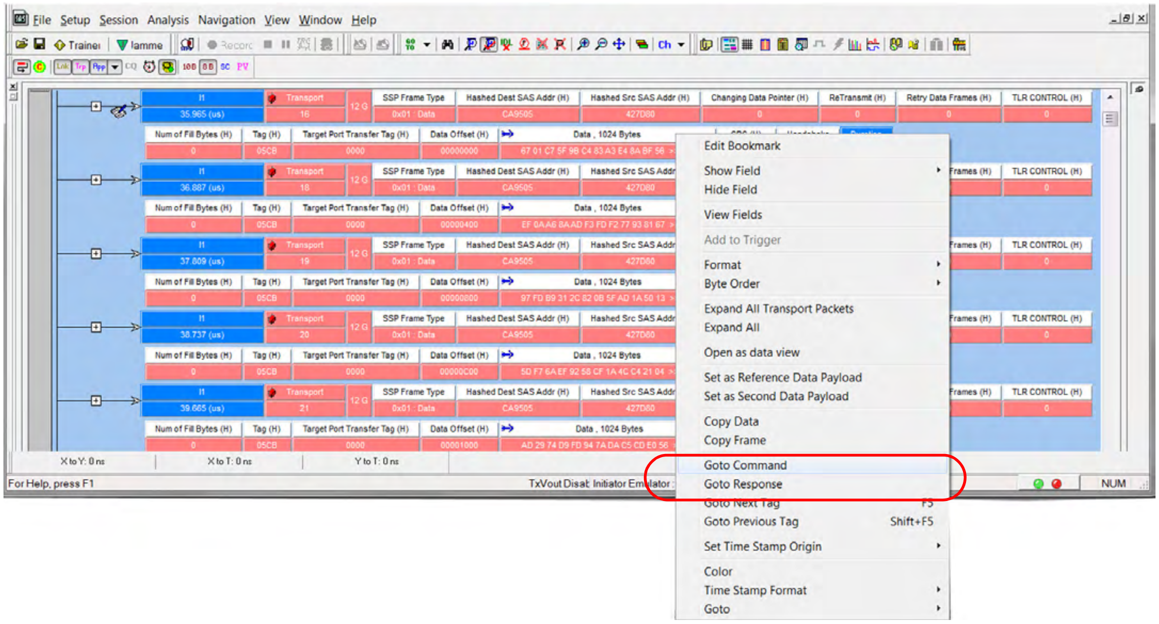

File Setup Session Analysis Navigation View Window Help
Edit Bookmark
Show Field
Hide Field
View Fields
Add to Trigger
Format
Byte Order
Expand All Transport Packets
Expand All
Open as data view
Set as Reference Data Payload
Set as Second Data Payload
Copy Data
Copy Frame
Goto Command
Goto Response
Goto Next Tag F5
Goto Previous Tag Shift+F5
Set Time Stamp Origin
Color
Time Stamp Format
Goto
For Help, press F1
NUM

Figure 3.20: Goto Command / Goto Response Menu

Clicking on Goto Command will take you to the Command Packet 1. See Figure 3.21 on page 135.

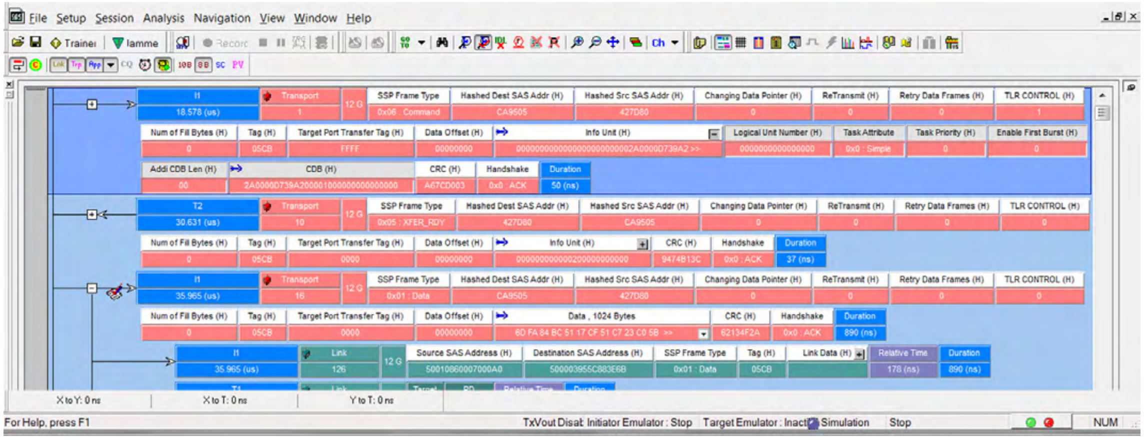


Figure 3.21: Typical Goto Command Trace

Clicking on Goto Response will take you to the Response Packet 35. See Figure 3.22 on page 135.

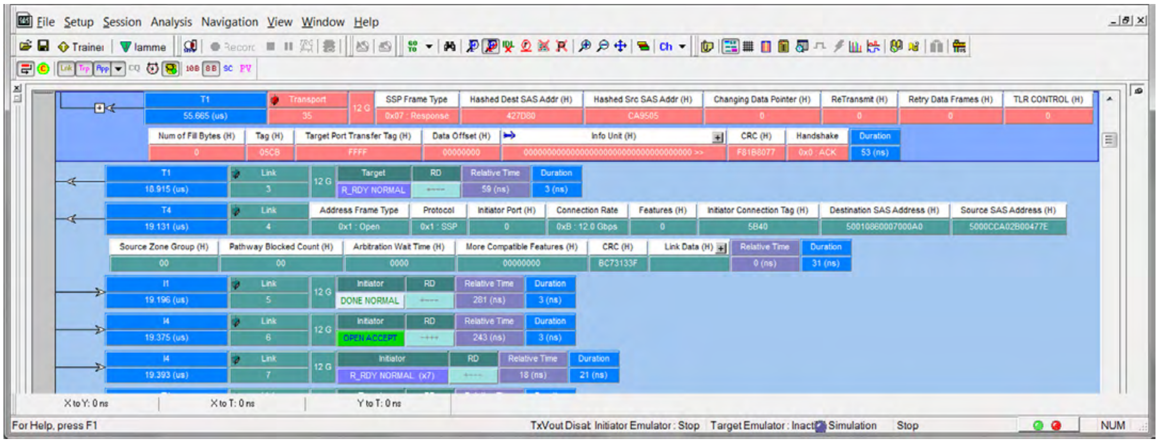


Figure 3.22: Goto Response Trace

Note: Export to Text/Excel is available from the Spreadsheet View, Packet View or Text View as of S/W version 5.60 or later. Export to Text/Excel is not available from Column View as of S/W version 5.60 or later.

3.3.4 Changing the Default View

Perform the following steps to change the default view of all trace files to Packet View:

1. Open a trace file.
2. Select the **Packet View**. Close all other views.
3. Select **File > Save Workspace** to open a Save As dialog. Save the current workspace as a **.wss** file.
4. Select **Setup > Preferences** to open the Preferences dialog.

5. In the Default Workspace field, enter the path and name of the workspace **.wss** file that you saved in step 3.

Because the default workspace contains only Packet View, the software opens trace files in Packet View.

3.3.5 Updating the Workspace

If you'd rather have a set of views open when you open a Trace, you can select a set you like and store that particular set of views as a *workspace_your_description.wss* file. The next time you open any Trace it will initially come up showing the Default Workspace (as shown in Changing the Default View on page 135), but then you can open a Workspace you have defined and the Trace will be displayed in your unique Workspace set.

Perform the following steps to define a set of views that you are interested in:

1. Open a trace file, in this case the 1.5-3.0-6.0 Trace has been opened. See Figure 3.23 on page 136.

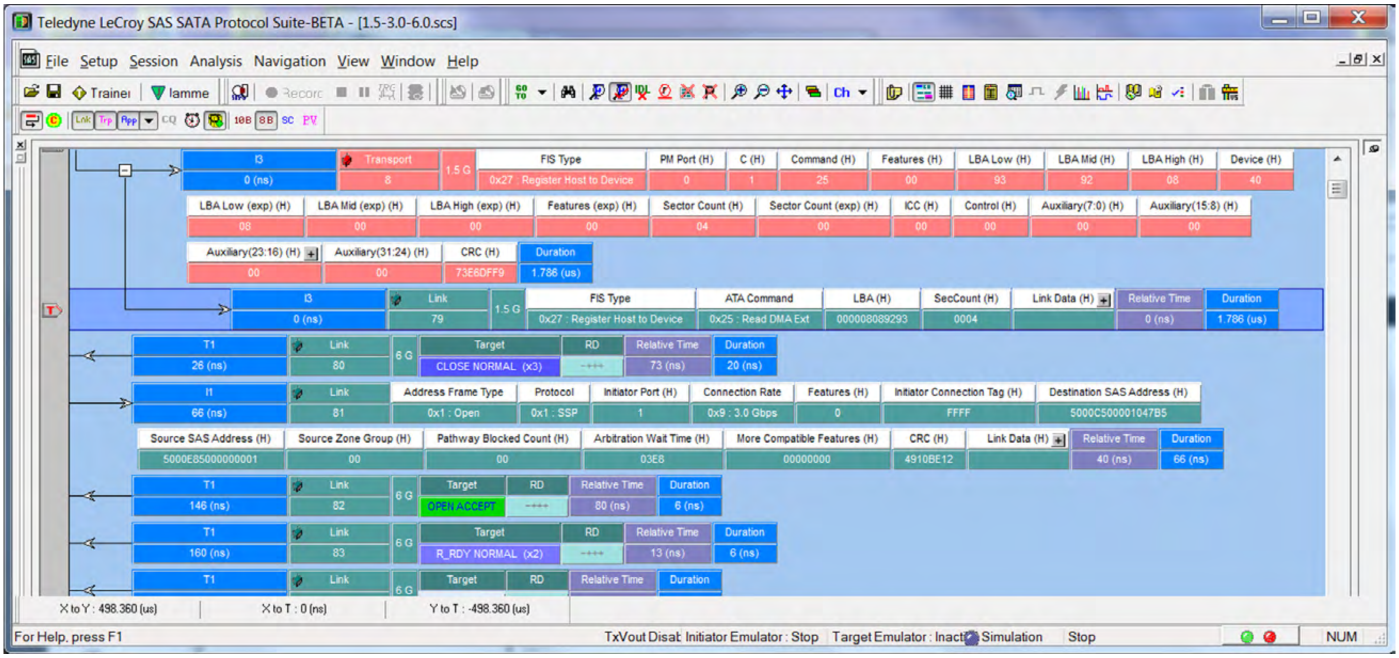

Teledyne LeCroy SAS SATA Protocol Suite-BETA - [1.5-3.0-6.0.scs]
File Setup Session Analysis Navigation View Window Help
For Help, press F1
NUM

Figure 3.23: Default Workspace (Trace View)

2. Select the other views you'd like to see. In this case, we have chosen Packet, Spreadsheet, Column and Bus Utilization. See Figure 3.24.

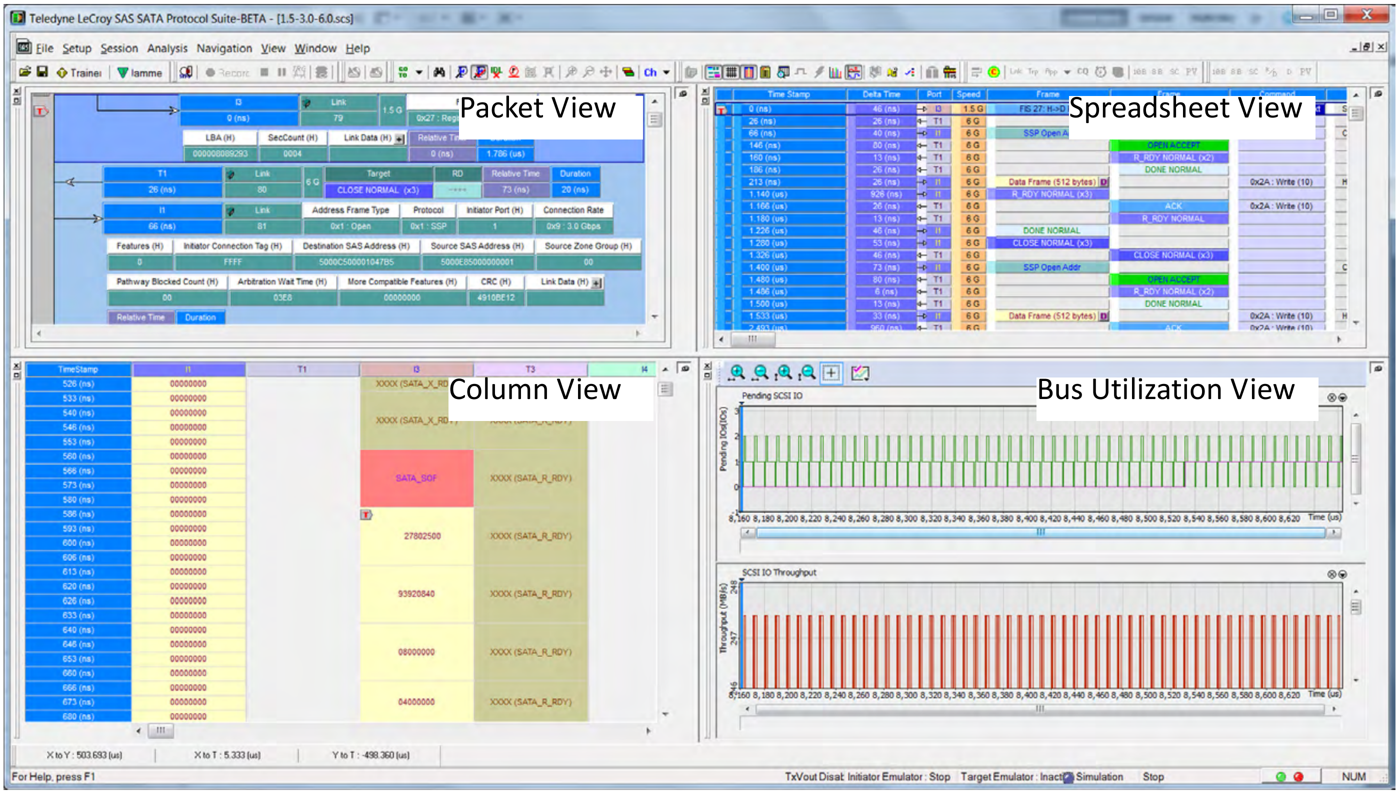

Teledyne LeCroy SAS SATA Protocol Suite-BETA - [1.5-3.0-6.0.scs]
File Setup Session Analysis Navigation View Window Help
Packet View
Spreadsheet View
Column View
Bus Utilization View
Pending SCSI IO
SCSI IO Throughput
For Help, press F1

Figure 3.24: Workspace with Four Views (Packet, Spreadsheet, Column, Bus Utilization)

3. Now you can save this set of Views to be called up later or as the Default Workspace per Changing the Default View on page 135.
4. If you Save the Workspace with four views as the Default, the next Trace you open will have all the views you want to see. See Figure 3.25.

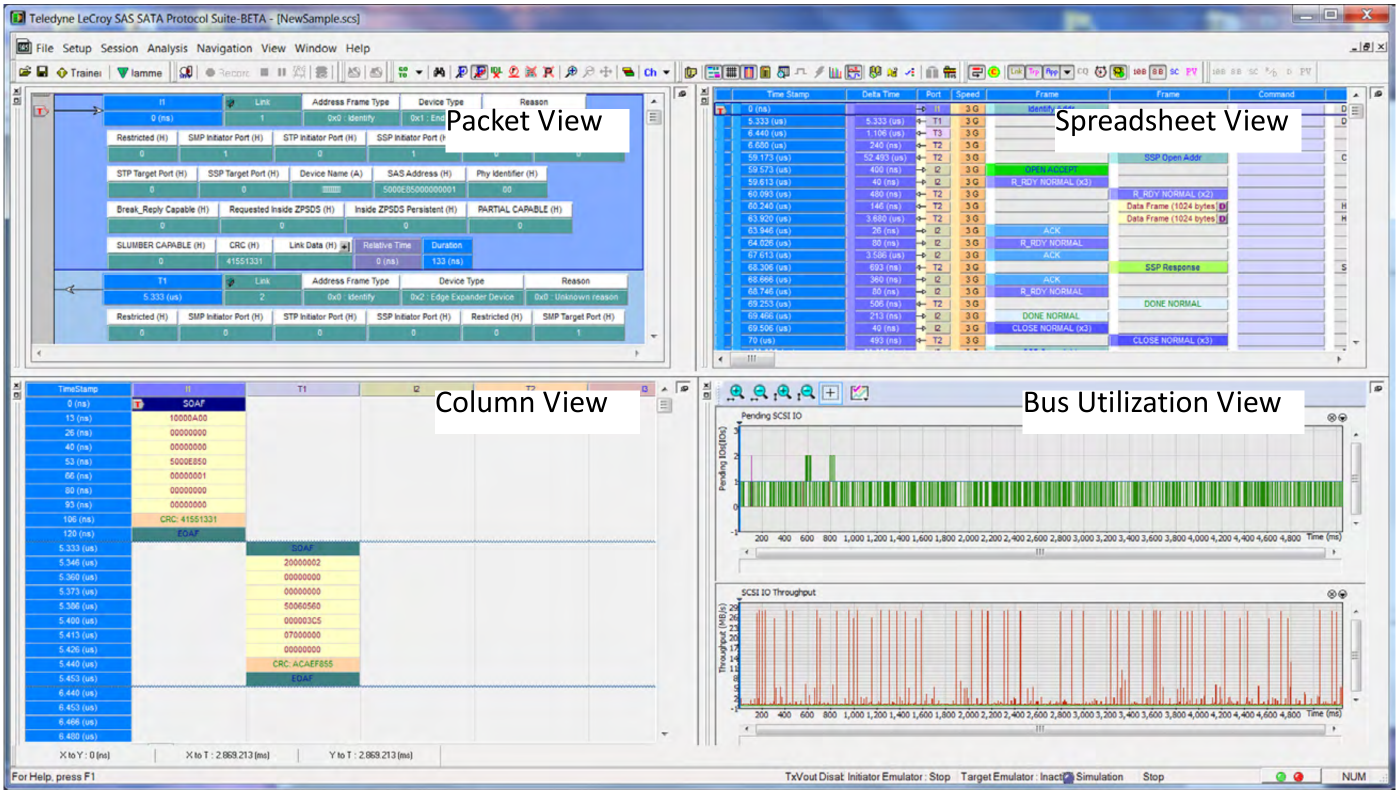
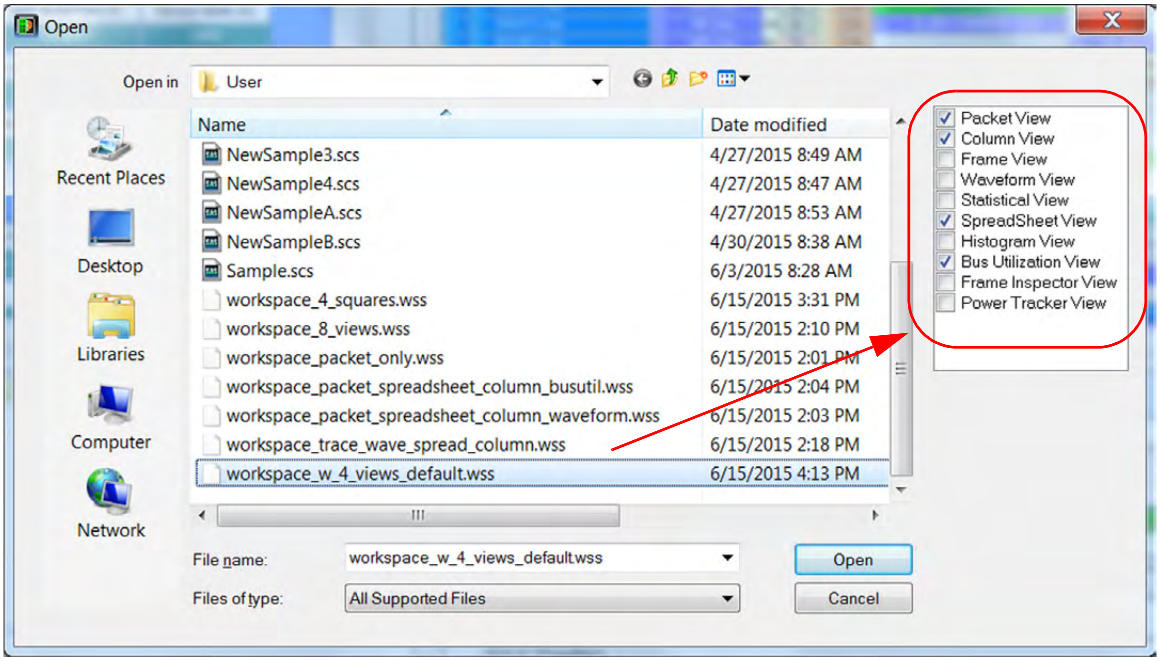

Teledyne LeCroy SAS SATA Protocol Suite-BETA - [NewSample.scs]
File Setup Session Analysis Navigation View Window Help
Packet View
Spreadsheet View
Column View
Bus Utilization View
Pending SCSI IO
SCSI IO Throughput
For Help, press F1
NUM

Figure 3.25: Default Workspace Contains Four Views (Trace = NewSample.scs)

5. If you want to know which Views make up the Workspace, select File -> Open -> then select the Workspace file: (workspace_w_4_views_default.wss). See Figure 3.26 on page 138.


Open
Open in
User
Recent Places
Desktop
Libraries
Computer
Network
Open
Cancel

Name	Date modified
NewSample3.scs	4/27/2015 8:49 AM
NewSample4.scs	4/27/2015 8:47 AM
NewSampleA.scs	4/27/2015 8:53 AM
NewSampleB.scs	4/30/2015 8:38 AM
Sample.scs	6/3/2015 8:28 AM
workspace_4_squares.wss	6/15/2015 3:31 PM
workspace_8_views.wss	6/15/2015 2:10 PM
workspace_packet_only.wss	6/15/2015 2:01 PM
workspace_packet_spreadsheet_column_busutil.wss	6/15/2015 2:04 PM
workspace_packet_spreadsheet_column_waveform.wss	6/15/2015 2:03 PM
workspace_trace_wave_spread_column.wss	6/15/2015 2:18 PM
workspace_w_4_views_default.wss	6/15/2015 4:13 PM

- ☑ Packet View
- ☑ Column View
- ☐ Frame View
- ☐ Waveform View
- ☐ Statistical View
- ☑ SpreadSheet View
- ☐ Histogram View
- ☑ Bus Utilization View
- ☐ Frame Inspector View
- ☐ Power Tracker View

File name: workspace_w_4_views_default.wss

Files of type: All Supported Files

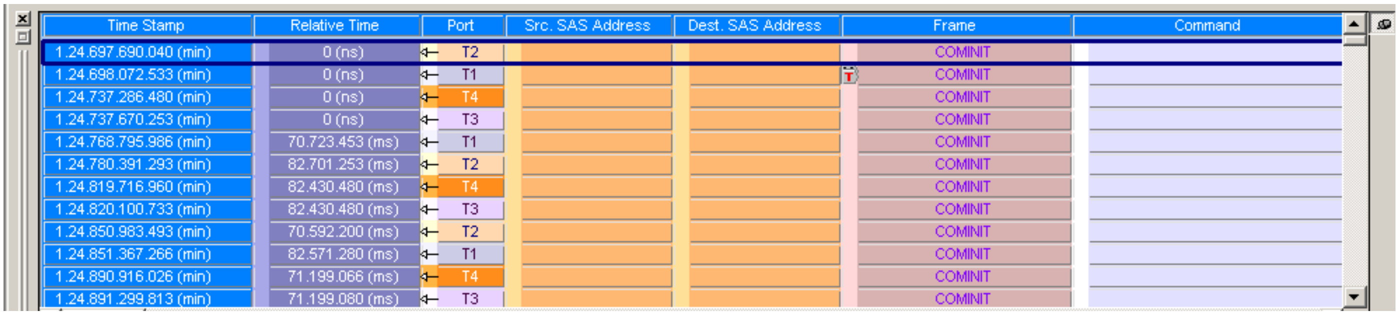
Figure 3.26: New Default Workspace with Four Views

6. To the right side of the window you can see the Packet, Column, Spreadsheet and Bus Utilization Views are selected.

3.3.6 Spreadsheet View

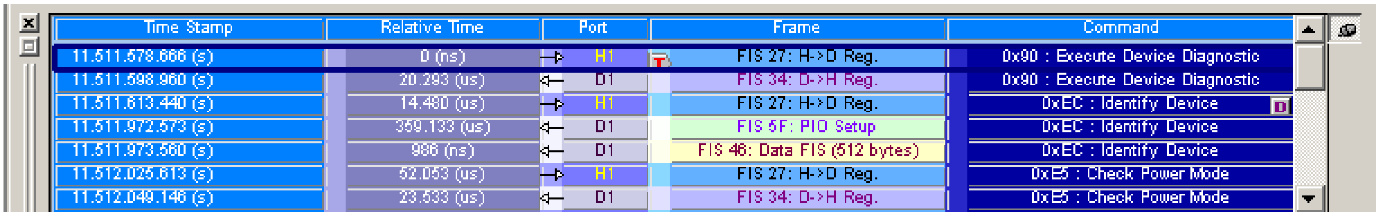
Spreadsheet View displays all of the Packet View fields in a time sequential spreadsheet format. To display the Spreadsheet View of the current capture, click

Analysis > Spreadsheet View or click the ▦ button on the toolbar (see Figure 3.27 on page 139).



Time Stamp	Relative Time	Port	Src. SAS Address	Dest. SAS Address	Frame	Command
1.24.697.690.040 (min)	0 (ns)	← T2			COMINIT	
1.24.698.072.533 (min)	0 (ns)	← T1			COMINIT	
1.24.737.286.480 (min)	0 (ns)	← T4			COMINIT	
1.24.737.670.253 (min)	0 (ns)	← T3			COMINIT	
1.24.768.795.986 (min)	70.723.453 (ms)	← T1			COMINIT	
1.24.780.391.293 (min)	82.701.253 (ms)	← T2			COMINIT	
1.24.819.716.960 (min)	82.430.480 (ms)	← T4			COMINIT	
1.24.820.100.733 (min)	82.430.480 (ms)	← T3			COMINIT	
1.24.850.983.493 (min)	70.592.200 (ms)	← T2			COMINIT	
1.24.851.367.266 (min)	82.571.280 (ms)	← T1			COMINIT	
1.24.890.916.026 (min)	71.199.066 (ms)	← T4			COMINIT	
1.24.891.299.813 (min)	71.199.080 (ms)	← T3			COMINIT	

Figure 3.27: SAS: Spreadsheet View.



Time Stamp	Relative Time	Port	Frame	Command
11.511.578.666 (s)	0 (ns)	→ H1	FIS 27: H->D Reg.	0x90 : Execute Device Diagnostic
11.511.598.960 (s)	20.293 (us)	← D1	FIS 34: D->H Reg.	0x90 : Execute Device Diagnostic
11.511.613.440 (s)	14.480 (us)	→ H1	FIS 27: H->D Reg.	0xEC : Identify Device
11.511.972.573 (s)	359.133 (us)	← D1	FIS 5F: PIO Setup	0xEC : Identify Device
11.511.973.560 (s)	986 (ns)	← D1	FIS 46: Data FIS (512 bytes)	0xEC : Identify Device
11.512.025.613 (s)	52.053 (us)	→ H1	FIS 27: H->D Reg.	0xE5 : Check Power Mode
11.512.049.146 (s)	23.533 (us)	← D1	FIS 34: D->H Reg.	0xE5 : Check Power Mode

Figure 3.28: SATA: Spreadsheet View.

Right-click a column heading to go to **Preferences**, make all columns the same width, choose **Time Stamp Format**, or **Goto** a position.

Right-click a column heading to **Hide** or **Show** the column. To show the same columns permanently, select **Setup> Preferences > Trace Viewer > As Previously Saved**.

Right-click the column to **Add Bookmark** or **Edit Bookmark**, **Set Time Stamp Origin**, go to **Preferences**, choose **Time Stamp Format**, **Change Background (or Foreground) Color**, or **Goto** a position.

Note: You can double-click a data frame to display the data payload view.
The Status column can show ABRT and UNC status.

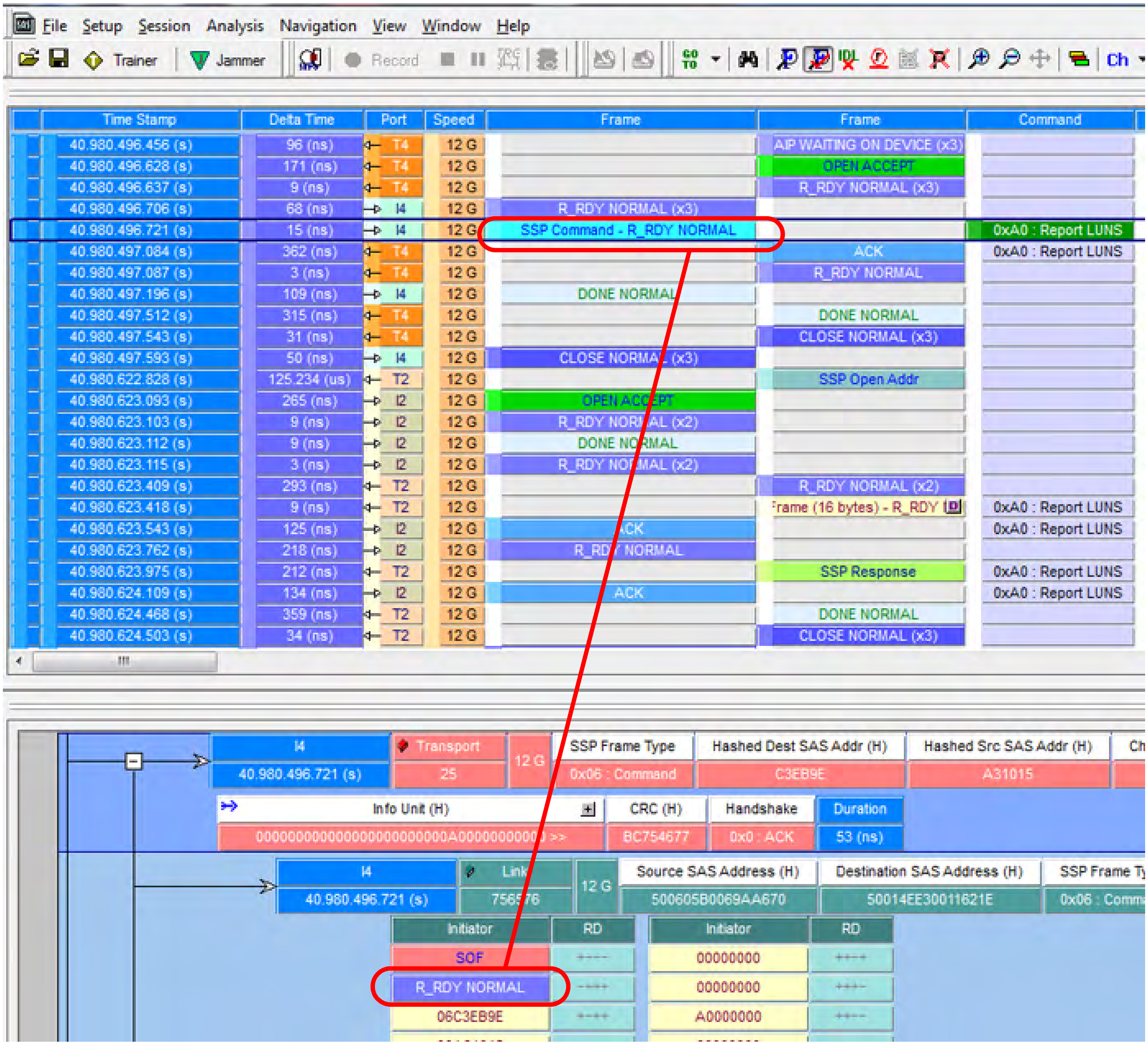
Primitives Displayed in Both Spreadsheet and Packet Views

The following primitives are shown if they are inside a frame:

❑ RRDY_NORMAL
❑ ACK
❑ NAK_CRC_ERROR
❑ CREDIT_BLOCKED

- ❑ BREAK
- ❑ DONE_ACK_NAK_TIMEOUT
- ❑ DONE_CREDIT_TIMEOUT
- ❑ DONE_NORMAL
- ❑ AIP_NORMAL
- ❑ SAS_ERROR

See Figure 3.29.



Time Stamp	Delta Time	Port	Speed	Frame	Frame	Command
40.980.496.456 (s)	96 (ns)	T4	12 G		AIP WAITING ON DEVICE (x3)	
40.980.496.628 (s)	171 (ns)	T4	12 G		OPEN ACCEPT	
40.980.496.637 (s)	9 (ns)	T4	12 G		R_RDY NORMAL (x3)	
40.980.496.706 (s)	68 (ns)	I4	12 G	R_RDY NORMAL (x3)		
40.980.496.721 (s)	15 (ns)	I4	12 G	SSP Command - R_RDY NORMAL		0xA0 : Report LUNS
40.980.497.084 (s)	362 (ns)	T4	12 G		ACK	0xA0 : Report LUNS
40.980.497.087 (s)	3 (ns)	T4	12 G		R_RDY NORMAL	
40.980.497.196 (s)	109 (ns)	I4	12 G	DONE NORMAL		
40.980.497.512 (s)	315 (ns)	T4	12 G		DONE NORMAL	
40.980.497.543 (s)	31 (ns)	T4	12 G		CLOSE NORMAL (x3)	
40.980.497.593 (s)	50 (ns)	I4	12 G	CLOSE NORMAL (x3)		
40.980.622.828 (s)	125.234 (us)	T2	12 G		SSP Open Addr	
40.980.623.093 (s)	265 (ns)	I2	12 G	OPEN ACCEPT		
40.980.623.103 (s)	9 (ns)	I2	12 G	R_RDY NORMAL (x2)		
40.980.623.112 (s)	9 (ns)	I2	12 G	DONE NORMAL		
40.980.623.115 (s)	3 (ns)	I2	12 G	R_RDY NORMAL (x2)		
40.980.623.409 (s)	293 (ns)	T2	12 G		R_RDY NORMAL (x2)	
40.980.623.418 (s)	9 (ns)	T2	12 G		rame (16 bytes) - R_RDY	0xA0 : Report LUNS
40.980.623.543 (s)	125 (ns)	I2	12 G	ACK		0xA0 : Report LUNS
40.980.623.762 (s)	218 (ns)	I2	12 G	R_RDY NORMAL		
40.980.623.975 (s)	212 (ns)	T2	12 G		SSP Response	0xA0 : Report LUNS
40.980.624.109 (s)	134 (ns)	I2	12 G	ACK		0xA0 : Report LUNS
40.980.624.468 (s)	359 (ns)	T2	12 G		DONE NORMAL	
40.980.624.503 (s)	34 (ns)	T2	12 G		CLOSE NORMAL (x3)	

I4	Transport		SSP Frame Type	Hashed Dest SAS Addr (H)	Hashed Src SAS Addr (H)	Ch
40.980.496.721 (s)	25	12 G	0x06 : Command	C3EB9E	A31015	

Info Unit (H)	CRC (H)	Handshake	Duration
0000000000000000000000A0000000000 >>	BC754677	0x0 : ACK	53 (ns)

I4	Link		Source SAS Address (H)	Destination SAS Address (H)	SSP Frame Ty
40.980.496.721 (s)	756576	12 G	500605B0069AA670	50014EE30011621E	0x06 : Comm

Initiator	RD	Initiator	RD
SOF	+----	00000000	++-+
R_RDY NORMAL	-+++	00000000	+++-
06C3EB9E	+-++	A0000000	++--

Figure 3.29: Primitives Shown in Spreadsheet and Packet Views

Export As Text/Excel

Select **File > Export > Export to Text/Excel** to open the Save As Text dialog.

For Save As Type, select **Text Files** or **Excel Files**.

Select options from With comma delimiter, Export Duration and Save in a Single CSV File.

For Save As Range, select **All Packets** or enter a cursor range.

Enter a **File Name** and click **Save**.

Note: When Spreadsheet View is exported to text, the XFER-Length field is always in hexadecimal format.

Note: Export to Text/Excel is available from the Spreadsheet View, Packet View or Text View as of S/W version 5.60 or later. Export to Text/Excel is not available from Column View as of S/W version 5.60 or later.

Change Format of Logical Block Address (LBA)

You can set different LBA formats in Packet View and Spreadsheet View. To change the LBA format, right-click the LBA column to display the popup menu, select **Format,** and change the format to **Decimal, Hexadecimal,** or **Binary**.

In Spreadsheet View, you can also Right-click on a column heading to go to **Preferences,** click the **Trace Viewer** and then the **Configuration** icon to display the **Trace Viewer Configuration** dialog. Expand the **Frame List/Spread Sheet View**, select **LBA/Sector#**, and change the **Format**. If you cannot change the format there, select the **Link Fields, Transport Fields, ATA Cmd. Fields**, or **SCSI Cmd. Fields** node, select the field (such as “LBA High”), and then change the **Format**.

Spreadsheet View Context Menu

In Spreadsheet View a Context Menu is available by performing a right click on an Frame packet. See Figure 3.30 on page 142.

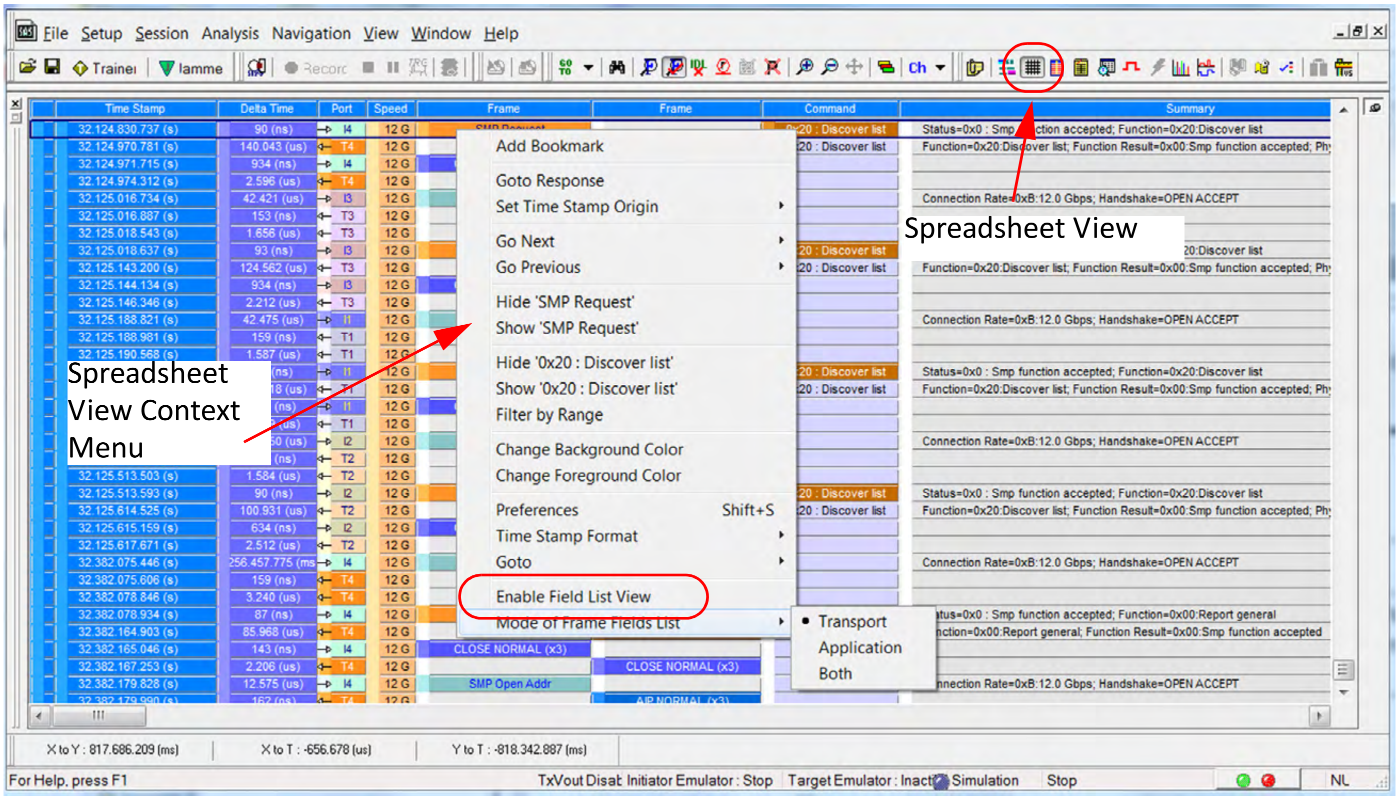
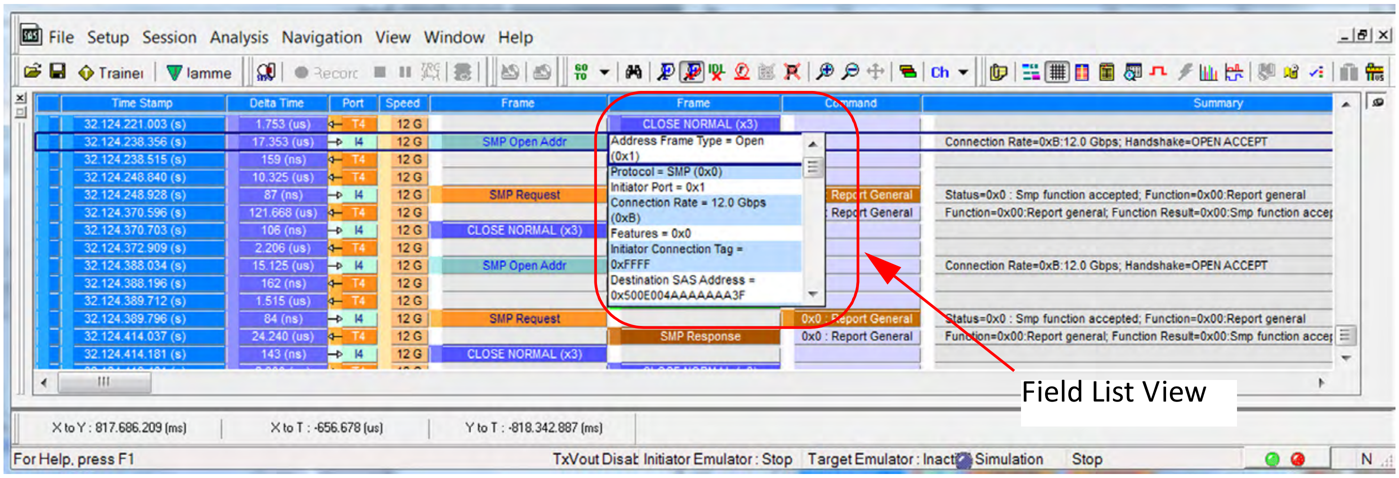

File Setup Session Analysis Navigation View Window Help
Spreadsheet View
Spreadsheet View Context Menu
Add Bookmark
Goto Response
Set Time Stamp Origin
Go Next
Go Previous
Hide 'SMP Request'
Show 'SMP Request'
Hide '0x20 : Discover list'
Show '0x20 : Discover list'
Filter by Range
Change Background Color
Change Foreground Color
Preferences Shift+S
Time Stamp Format
Goto
Enable Field List View
Mode of Frame Fields List
Transport
Application
Both
For Help, press F1

Figure 3.30: Spreadsheet View Context Menu

From this window you can select the Enable Field List View and the Field List View will pop up, see Figure 3.31.


File Setup Session Analysis Navigation View Window Help
Field List View
For Help, press F1

Address Frame Type = Open (0x1)
Protocol = SMP (0x0)
Initiator Port = 0x1
Connection Rate = 12.0 Gbps (0xB)
Features = 0x0
Initiator Connection Tag = 0xFFFF
Destination SAS Address = 0x500E004AAAAAAA3F

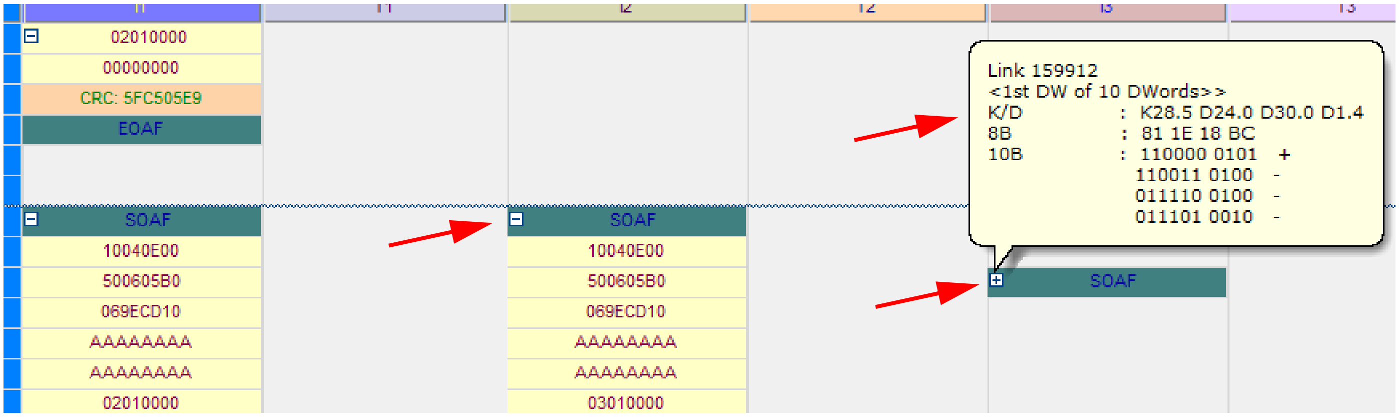
Figure 3.31: Field List View

The Field List View contains information about the selected Packet.

3.3.7 Column View

Column View displays the captured data grouped in columns by port (see Figure 3.32 on page 143). Each row shows captured DWORDs on different ports related to the timestamp. It also shows different speed (1.5G, 3G, 6G, 12G) DWORDs. Different DWORD cell height shows the duration of the DWORD. To display Column View of the current capture, click **Analysis > Column View** or click the button on the toolbar.

You can click the + sign to expand the packet and - sign to collapse the packet. Hovering over the signs displays a tooltip showing the contents of the packet. Right-click a packet to change the background and foreground color. (see the arrows in Figure 3.32 on page 143).


02010000
00000000
CRC: 5FC505E9
EOAF
SOAF
10040E00
500605B0
069ECD10
AAAAAAAA
AAAAAAAA
02010000
SOAF
10040E00
500605B0
069ECD10
AAAAAAAA
AAAAAAAA
03010000
SOAF

```
Link 159912
<1st DW of 10 DWords>>
K/D         :  K28.5 D24.0 D30.0 D1.4
8B          :  81 1E 18 BC
10B         :  110000 0101   +
               110011 0100   -
               011110 0100   -
               011101 0010   -
```

Figure 3.32: SAS: Column View

Right-click in the Column View to display commands:

- Add Bookmark
- Expand All
- Preferences
- Time Stamp Format (LeCroy Format, Milli Second, Micro Second)
- Go to (Trigger Position, X Position, Y Position, Packet Number, Time Stamp, Bookmark, Begin, End)
- Set X-Pointer
- Set Y-Pointer
- Change Background Color
- Change Foreground Color

Note: The Column View displays the CRC value. To see different formats (10b, 8b, scrambled, and so on), select a format by clicking its Tool menu button.

Note: The Column View displays the CRC value. To see different formats (10b, 8b, scrambled, and so on), Export to Text/Excel command is not available

---

Resize Columns

You can resize the columns in Column View by clicking in the column boundary and dragging the boundary to a new position.

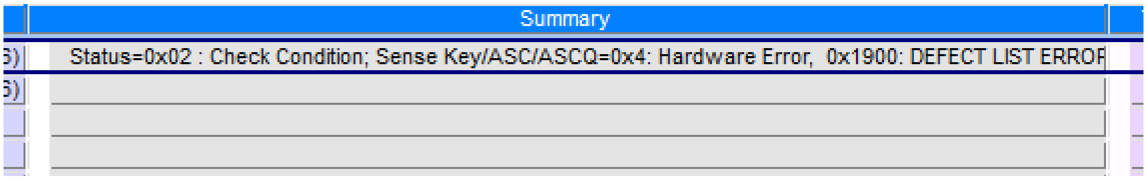
Rearrange Columns

You can rearrange columns by left-clicking in the column title and then dragging the drag-and-drop icon 🟩 to a new position.

Viewing Check Condition Sense Data

When a Check Condition error occurs, you can view decode data from it.

When an event is viewed from Packet View it also becomes visible in column view



Summary
Status=0x02 : Check Condition; Sense Key/ASC/ASCQ=0x4: Hardware Error, 0x1900: DEFECT LIST ERROR

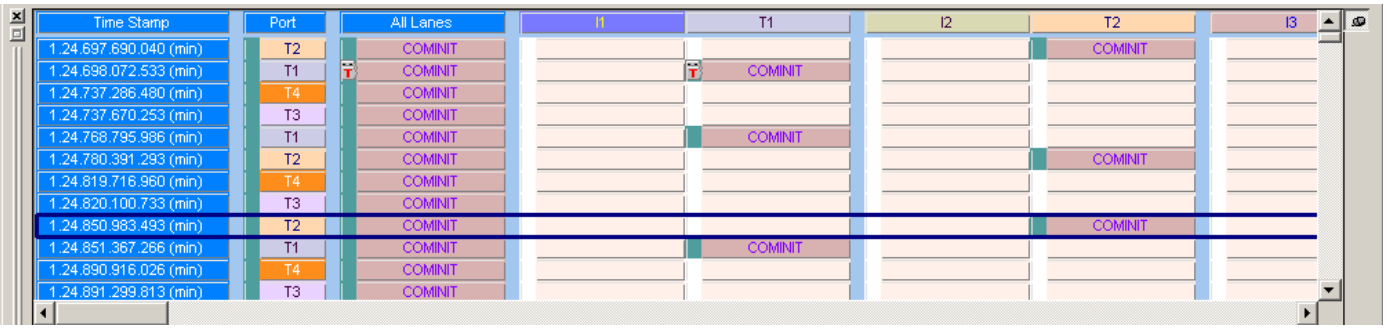
Figure 3.33: Check Condition in Column view.

Note: Export to Text/Excel is available from the Spreadsheet View, Packet View or Text View as of S/W version 5.60 or later. Export to Text/Excel is not available from Column View as of S/W version 5.60 or later.

3.3.8 Text View

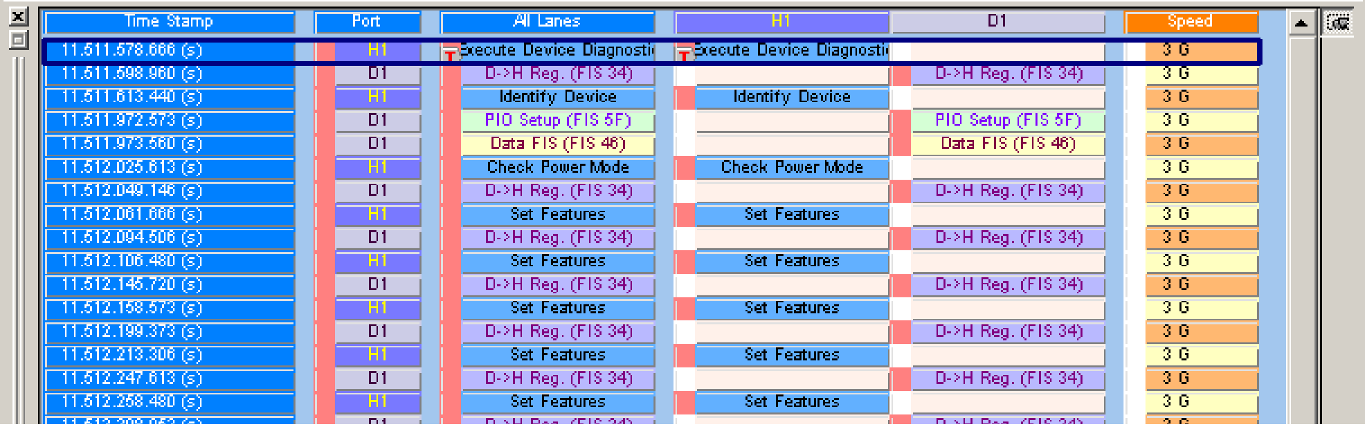
Text View displays the captured data interpreted as transaction frames, grouped in columns by port.

To display Text View (see Figure 3.34 on page 144), select **Analysis > Text View** or click the 📋 button on the toolbar.



Time Stamp	Port	All Lanes	I1	T1	I2	T2	I3
1.24.697.690.040 (min)	T2	COMINIT				COMINIT	
1.24.698.072.533 (min)	T1	COMINIT		COMINIT			
1.24.737.286.480 (min)	T4	COMINIT					
1.24.737.670.253 (min)	T3	COMINIT					
1.24.768.795.986 (min)	T1	COMINIT		COMINIT			
1.24.780.391.293 (min)	T2	COMINIT				COMINIT	
1.24.819.716.960 (min)	T4	COMINIT					
1.24.820.100.733 (min)	T3	COMINIT					
1.24.850.983.493 (min)	T2	COMINIT				COMINIT	
1.24.851.367.266 (min)	T1	COMINIT		COMINIT			
1.24.890.916.026 (min)	T4	COMINIT					
1.24.891.299.813 (min)	T3	COMINIT					

Figure 3.34: SAS: Text View.



Time Stamp	Port	All Lanes	H1	D1	Speed
11.511.578.666 (s)	H1	Execute Device Diagnosti	Execute Device Diagnosti		3 G
11.511.598.960 (s)	D1	D->H Reg. (FIS 34)		D->H Reg. (FIS 34)	3 G
11.511.613.440 (s)	H1	Identify Device	Identify Device		3 G
11.511.972.573 (s)	D1	PIO Setup (FIS 5F)		PIO Setup (FIS 5F)	3 G
11.511.973.560 (s)	D1	Data FIS (FIS 46)		Data FIS (FIS 46)	3 G
11.512.025.613 (s)	H1	Check Power Mode	Check Power Mode		3 G
11.512.049.146 (s)	D1	D->H Reg. (FIS 34)		D->H Reg. (FIS 34)	3 G
11.512.061.666 (s)	H1	Set Features	Set Features		3 G
11.512.094.506 (s)	D1	D->H Reg. (FIS 34)		D->H Reg. (FIS 34)	3 G
11.512.106.480 (s)	H1	Set Features	Set Features		3 G
11.512.145.720 (s)	D1	D->H Reg. (FIS 34)		D->H Reg. (FIS 34)	3 G
11.512.158.573 (s)	H1	Set Features	Set Features		3 G
11.512.199.373 (s)	D1	D->H Reg. (FIS 34)		D->H Reg. (FIS 34)	3 G
11.512.213.306 (s)	H1	Set Features	Set Features		3 G
11.512.247.613 (s)	D1	D->H Reg. (FIS 34)		D->H Reg. (FIS 34)	3 G
11.512.258.480 (s)	H1	Set Features	Set Features		3 G

Figure 3.35: SATA: Text View

Note: The LBA and Tag Number value are shown in the All Lanes column.

Identify Device Frame

When in Text View, if a trace has an Identify Device frame (as shown in Figure 3.36 on page 145).

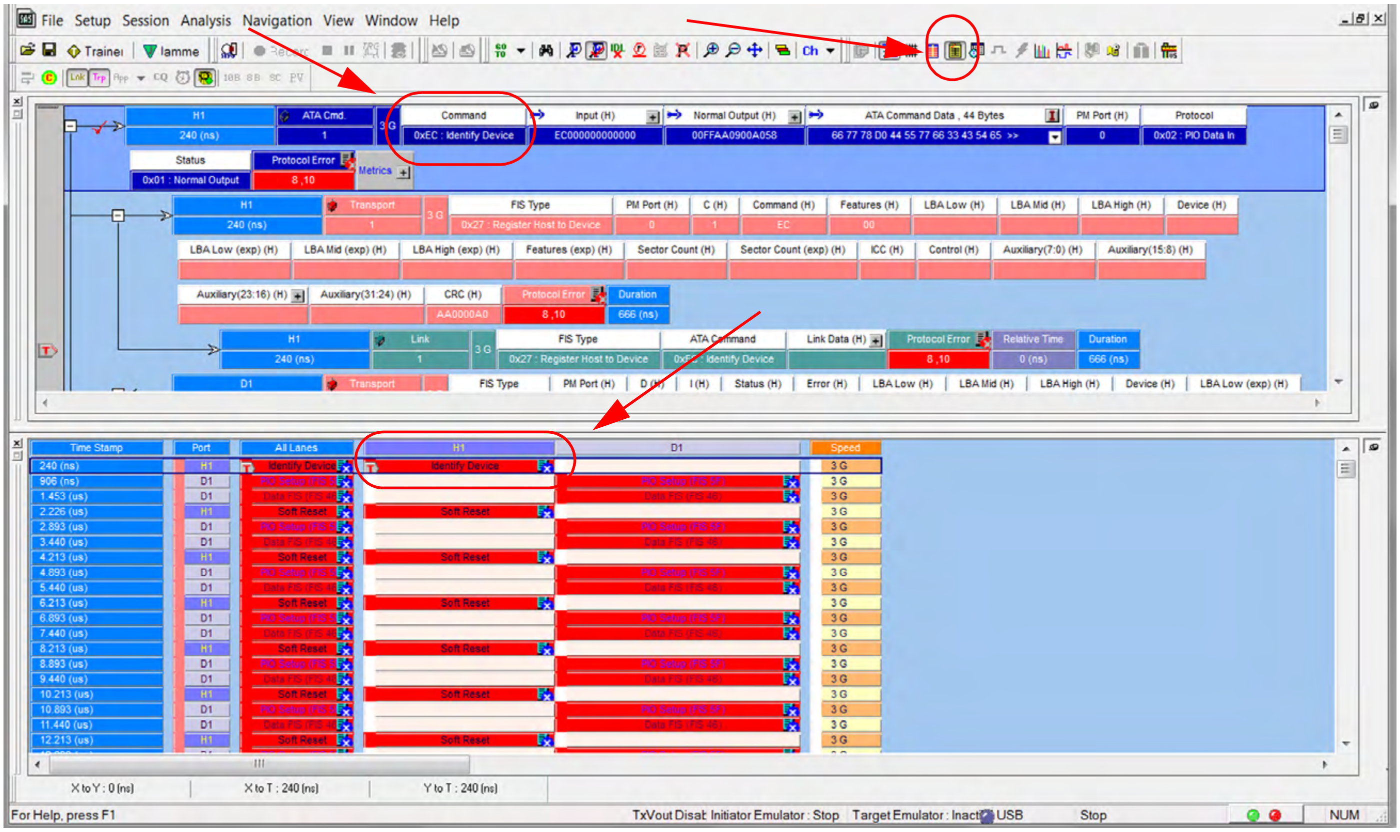
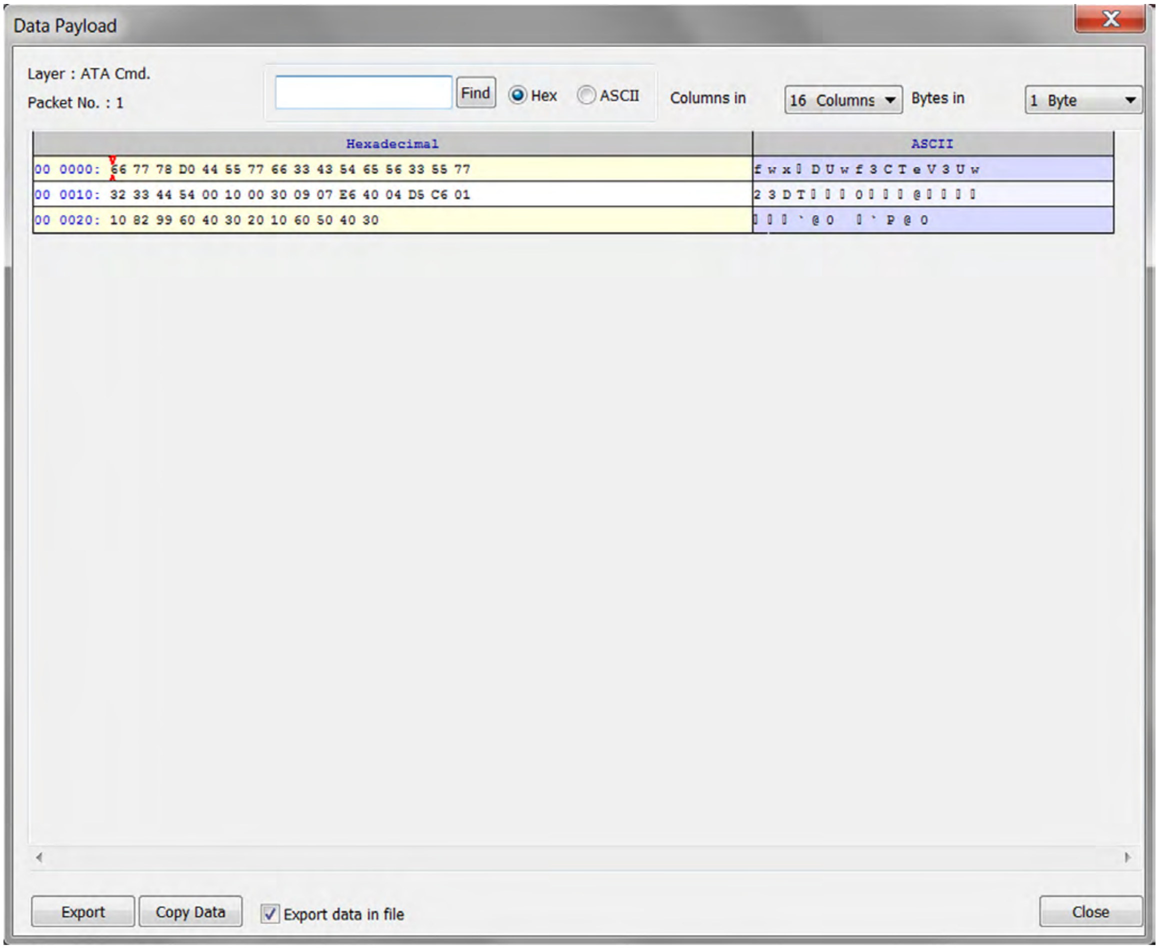


Figure 3.36: Identify Device Frame

Double clicking in the Identify Device Frame (while in Text Mode) will pop up the Data Payload View. See Figure 3.37 on page 146.

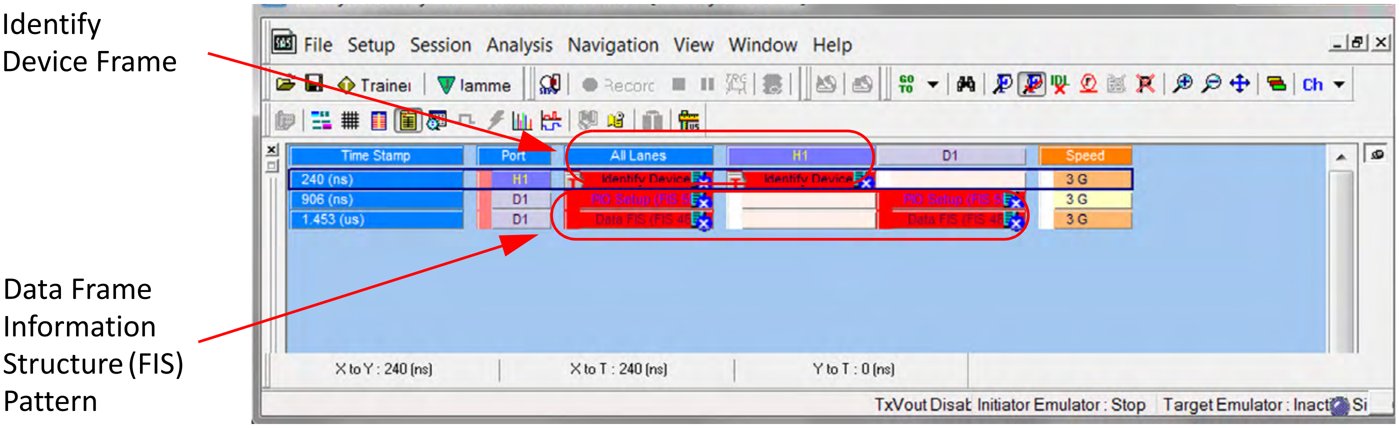

Data Payload
Find
● Hex
○ ASCII
Columns in
16 Columns
Bytes in
1 Byte
Export
Copy Data
☑ Export data in file
Close

Layer : ATA Cmd.
Packet No. : 1

```
                         Hexadecimal                               ASCII
00 0000: 66 77 78 D0 44 55 77 66 33 43 54 65 56 33 55 77   f w x ▯ D U w f 3 C T e V 3 U w
00 0010: 32 33 44 54 00 10 00 30 09 07 E6 40 04 D5 C6 01   2 3 D T ▯ ▯ ▯ 0 ▯ ▯ ▯ @ ▯ ▯ ▯ ▯
00 0020: 10 82 99 60 40 30 20 10 60 50 40 30               ▯ ▯ ▯ ` @ 0   ▯ ` P @ 0
```

Figure 3.37: Data Payload View from Identify Device Frame in Text Mode

The data payload is valid because the Identify Device Frame includes a Data Frame Information Structure (FIS) pattern (SATA only). See Figure 3.38.


Identify Device Frame
Data Frame Information Structure (FIS) Pattern
File Setup Session Analysis Navigation View Window Help
Trainer
Jamme
Record
Ch

Time Stamp	Port	All Lanes	H1	D1	Speed
240 (ns)	H1	Identify Device	Identify Device		3 G
906 (ns)	D1	PIO Setup (FIS 5F)		PIO Setup (FIS 5F)	3 G
1.453 (us)	D1	Data FIS (FIS 46)		Data FIS (FIS 46)	3 G

X to Y : 240 (ns) | X to T : 240 (ns) | Y to T : 0 (ns)

TxVout Disab Initiator Emulator : Stop | Target Emulator : Inact Si

Figure 3.38: Data FIS Pattern in Identify Device Frame

Note: Export to Text/Excel is available from the Spreadsheet View, Packet View or Text View as of S/W version 5.60 or later. Export to Text/Excel is not available from Column View as of S/W version 5.60 or later.

Text View Context Menu

In Text View mode the Context Menu is available by performing a right click on a packet. See Figure 3.39.

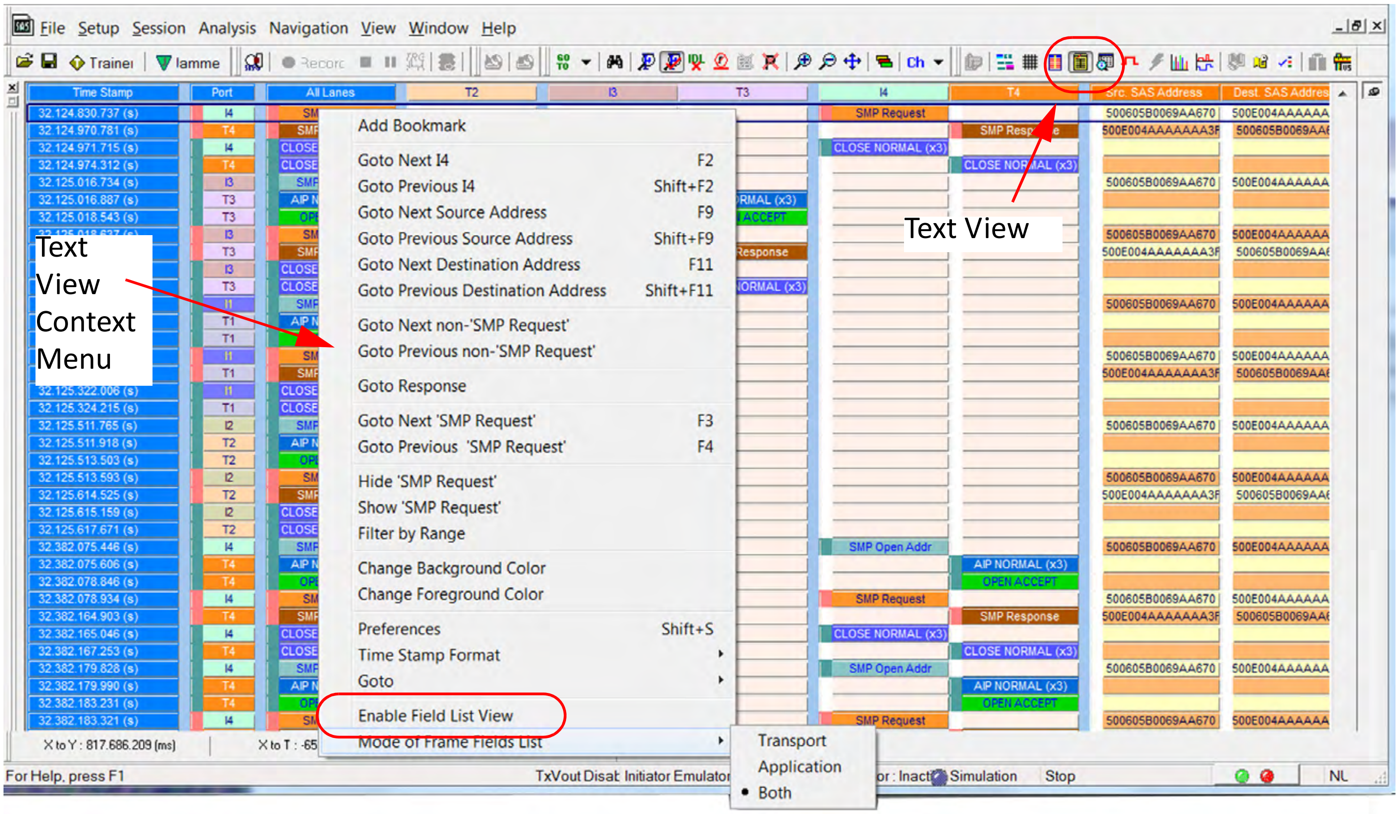
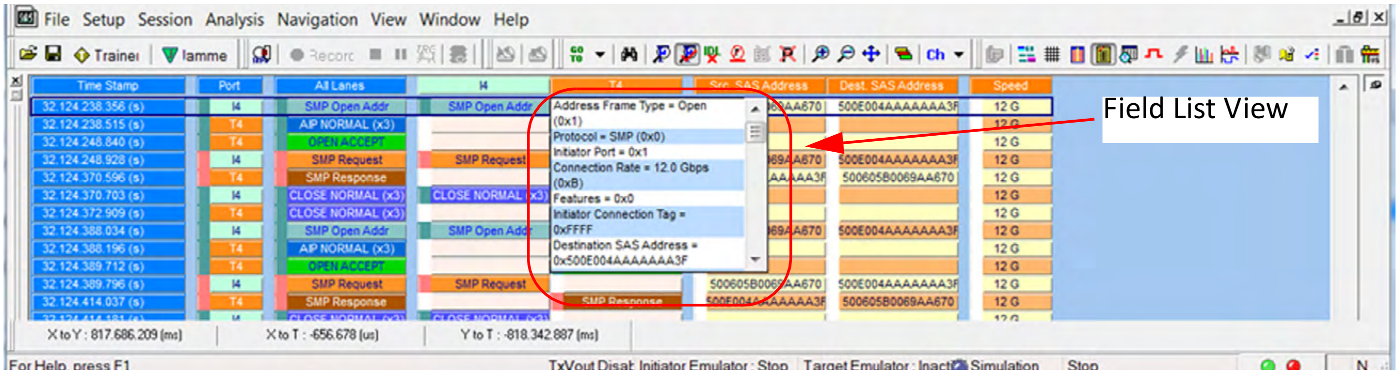

Text View Context Menu
Text View
Add Bookmark
Goto Next I4 F2
Goto Previous I4 Shift+F2
Goto Next Source Address F9
Goto Previous Source Address Shift+F9
Goto Next Destination Address F11
Goto Previous Destination Address Shift+F11
Goto Next non-'SMP Request'
Goto Previous non-'SMP Request'
Goto Response
Goto Next 'SMP Request' F3
Goto Previous 'SMP Request' F4
Hide 'SMP Request'
Show 'SMP Request'
Filter by Range
Change Background Color
Change Foreground Color
Preferences Shift+S
Time Stamp Format
Goto
Enable Field List View
Mode of Frame Fields List
Transport
Application
Both

Figure 3.39: Text View Context Menu

From this window you can select the Enable Field List View and the Field List View will popup, see Figure 3.40.


Field List View

Address Frame Type = Open (0x1)
Protocol = SMP (0x0)
Initiator Port = 0x1
Connection Rate = 12.0 Gbps (0xB)
Features = 0x0
Initiator Connection Tag = 0xFFFF
Destination SAS Address = 0x500E004AAAAAAA3F

Figure 3.40: Field List View

The Field List View contains information about the selected Packet.

3.3.9 Frame Inspector View

Frame Inspector View has lots of information that is available in Packet View, but not Spreadsheet View, so it is most useful in conjunction with the Spreadsheet View.
This view has the following three tabs:

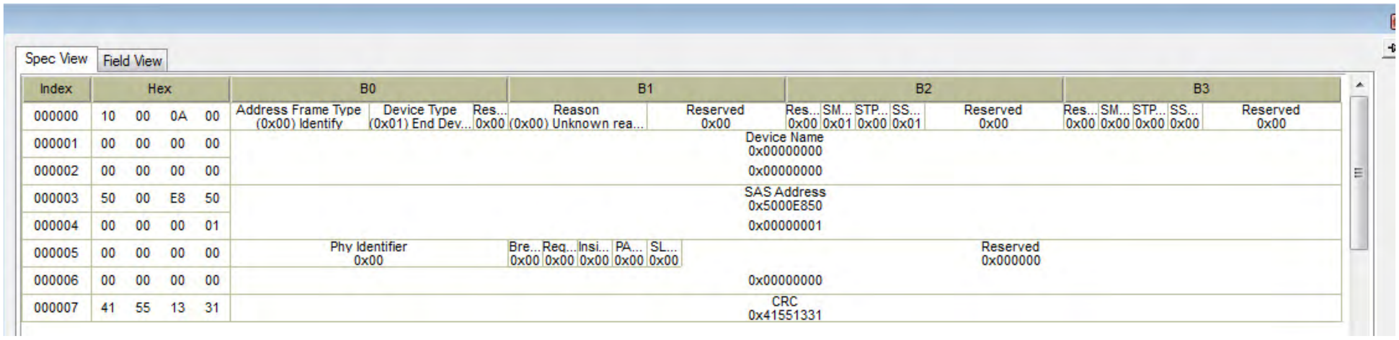
Spec View:

This view shows the Frame as it would appear in the spec, with the field names and values spelled out clearly. Fields that are too short to clearly contain the description can be viewed as tooltips by hovering the mouse over them. Some fields might have a a lowercase ‘e’ button at the top right corner. Pressing this button displays an ‘expanded’ view of the sub-fields in this field.

Field View:

This view shows, when applicable, a hierarchical display of the selected Packet, with the relevant fields in each level.

To open a Frame Inspector View of the current capture, select **View > Frame Inspector View** or click the button on the View Type toolbar (see Figure 3.41 on page 148).

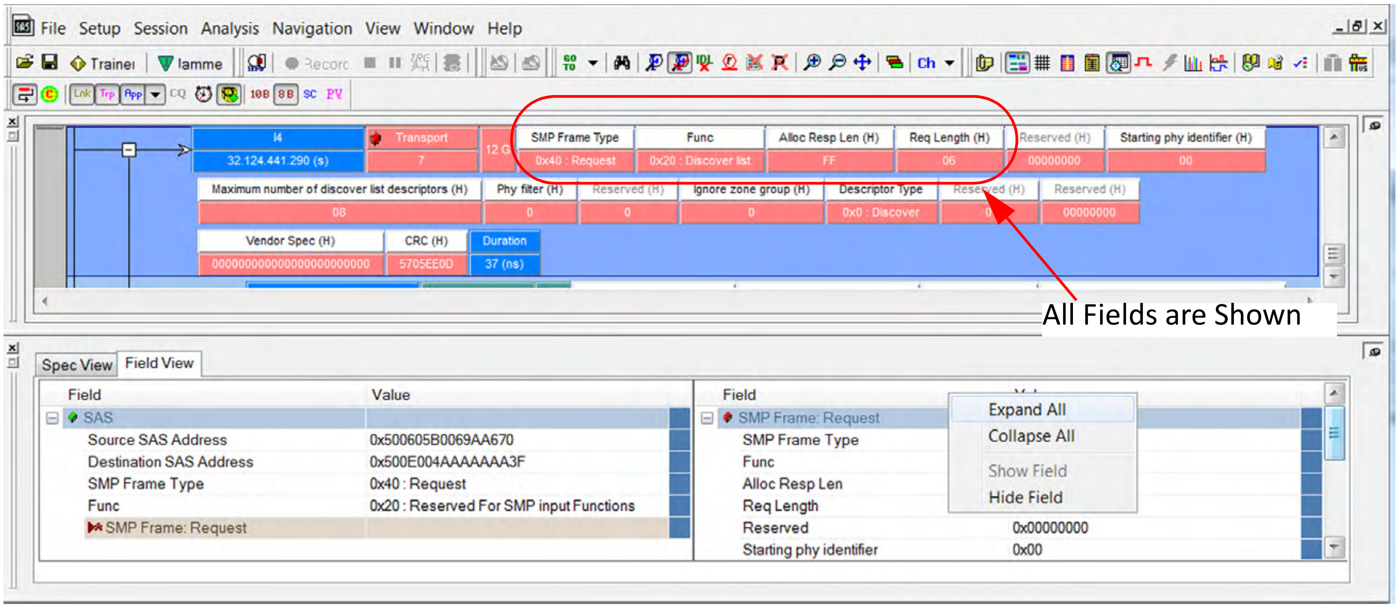


Index	Hex	B0	B1	B2	B3
000000	10 00 0A 00	Address Frame Type (0x00) Identify Device Type (0x01) End Dev... Res... 0x00	Reason (0x00) Unknown rea... Reserved 0x00	Res... 0x00 SM... 0x01 STP... 0x00 SS... 0x01 Reserved 0x00	Res... 0x00 SM... 0x00 STP... 0x00 SS... 0x00 Reserved 0x00
000001	00 00 00 00	Device Name 0x00000000			
000002	00 00 00 00	0x00000000			
000003	50 00 E8 50	SAS Address 0x5000E850			
000004	00 00 00 01	0x00000001			
000005	00 00 00 00	Phy Identifier 0x00	Bre... 0x00 Req... 0x00 Insi... 0x00 PA... 0x00 SL... 0x00 Reserved 0x000000		
000006	00 00 00 00	0x00000000			
000007	41 55 13 31	CRC 0x41551331			

Figure 3.41: Frame Inspector View

Field View Display Manipulation

If you select Field View, each Field and it’s Value for the selected Packet will be displayed (see Figure 3.42 on page 149).


File Setup Session Analysis Navigation View Window Help
Trainer
Jammer
Record
I4
32.124.441.290 (s)
Transport
7
12 G
SMP Frame Type
0x40 : Request
Func
0x20 : Discover list
Alloc Resp Len (H)
FF
Req Length (H)
06
Reserved (H)
00000000
Starting phy identifier (H)
00
Maximum number of discover list descriptors (H)
08
Phy filter (H)
0
Reserved (H)
0
Ignore zone group (H)
0
Descriptor Type
0x0 : Discover
Reserved (H)
0
Reserved (H)
00000000
Vendor Spec (H)
000000000000000000000000
CRC (H)
5705EE0D
Duration
37 (ns)
Spec View
Field View
Expand All
Collapse All
Show Field
Hide Field

All Fields are Shown

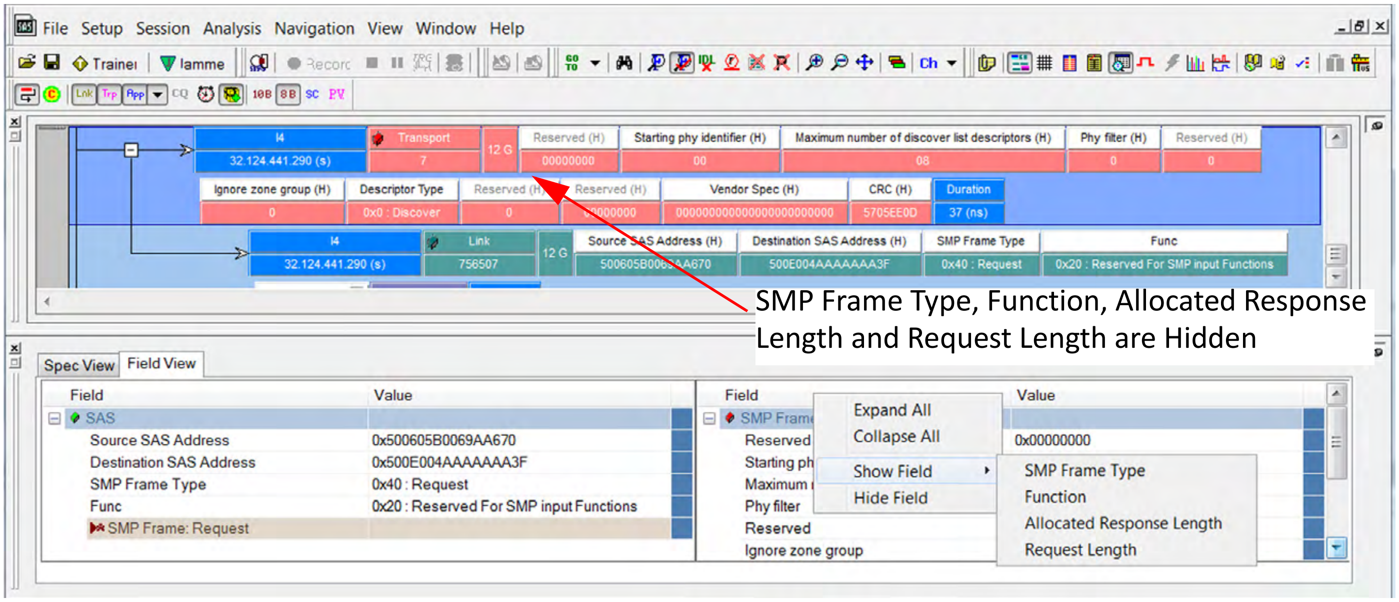
Field	Value
SAS	
Source SAS Address	0x500605B0069AA670
Destination SAS Address	0x500E004AAAAAAA3F
SMP Frame Type	0x40 : Request
Func	0x20 : Reserved For SMP input Functions
SMP Frame: Request	

Field	Value
SMP Frame: Request	
SMP Frame Type	
Func	
Alloc Resp Len	
Req Length	
Reserved	0x00000000
Starting phy identifier	0x00

Figure 3.42: Field Inspector -- Field View Display Selected for a Specific Packet

If you want to manipulate the Field View display, you have the following options:

- Expand All (All fields will be displayed)
- Collapse All (Only the Packet type will be displayed)
- Show Field (Fields which have been hidden will show in the menu)
- Hide Field (You can select Fields to be hidden)
  You can select several Fields to Hide. This will remove them from the Field View but will also remove them from the Packet View. See Figure 3.43.


File Setup Session Analysis Navigation View Window Help
Trainer
Jammer
Record
I4
32.124.441.290 (s)
Transport
7
12 G
Reserved (H)
00000000
Starting phy identifier (H)
00
Maximum number of discover list descriptors (H)
08
Phy filter (H)
0
Reserved (H)
0
Ignore zone group (H)
0
Descriptor Type
0x0 : Discover
Reserved (H)
0
Reserved (H)
00000000
Vendor Spec (H)
000000000000000000000000
CRC (H)
5705EE0D
Duration
37 (ns)
I4
32.124.441.290 (s)
Link
756507
12 G
Source SAS Address (H)
500605B0069AA670
Destination SAS Address (H)
500E004AAAAAAA3F
SMP Frame Type
0x40 : Request
Func
0x20 : Reserved For SMP input Functions
Spec View
Field View
Expand All
Collapse All
Show Field
Hide Field
SMP Frame Type
Function
Allocated Response Length
Request Length

SMP Frame Type, Function, Allocated Response Length and Request Length are Hidden

Field	Value
SAS	
Source SAS Address	0x500605B0069AA670
Destination SAS Address	0x500E004AAAAAAA3F
SMP Frame Type	0x40 : Request
Func	0x20 : Reserved For SMP input Functions
SMP Frame: Request	

Field	Value
SMP Fram	
Reserved	0x00000000
Starting ph	
Maximum	
Phy filter	
Reserved	
Ignore zone group	

Figure 3.43: Field Inspector with Fields Hidden

To display the Hidden Fields simply select them in the Show Field box. They will then be displayed in both the Packet View and the Field View.

3.3.10 Waveform Display

You can enable a waveform display for all active ports, and perform timing measurements, by positioning timing cursors within the waveform display.

Select **Analysis > Wave Form View** or click the **Show/Hide Waveform** button on the toolbar to enable the waveform display.

The Compact View shows the OOB Sequence with speed negotiation.

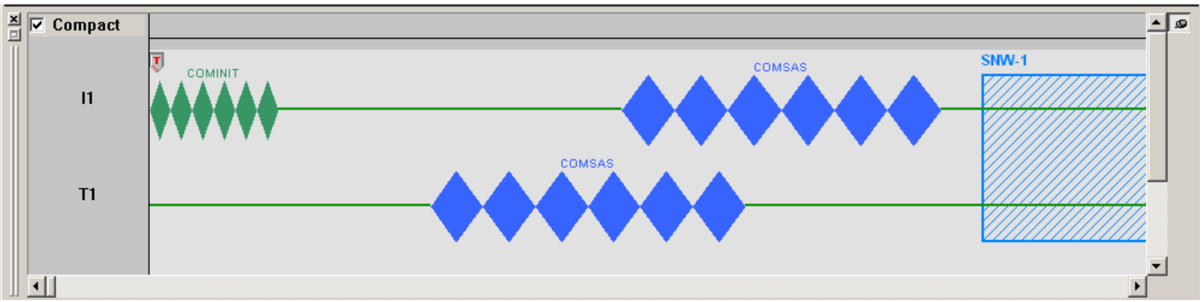

☑ Compact
I1
T1
T
COMINIT
COMSAS
COMSAS
SNW-1

Figure 3.44: SAS: Waveform View

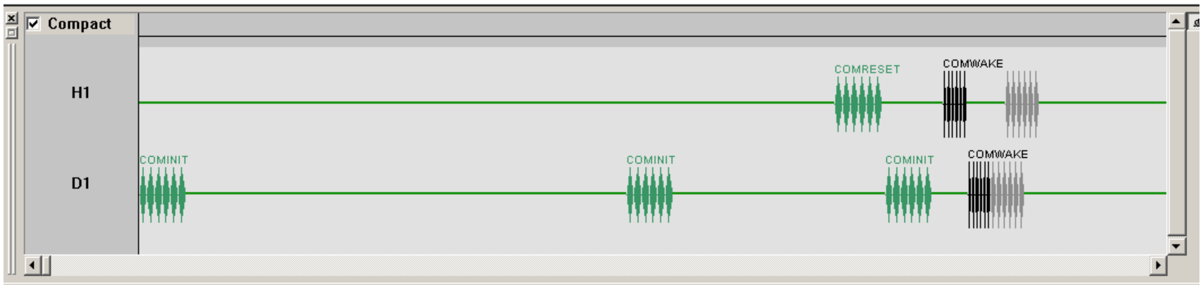

☑ Compact
H1
D1
COMRESET
COMWAKE
COMINIT
COMINIT
COMINIT
COMWAKE

Figure 3.45: SATA: Waveform View

Making a Timing Measurement

Timing measurements are made with two timing cursors T1 and T2. Click the left mouse button in the gray bar on the top of the waveform display at a point for the T1 cursor, and the right mouse button at a point for the T2 cursor. The time difference between the cursors is on a line connecting the two cursors (see Figure 3.46 on page 150).

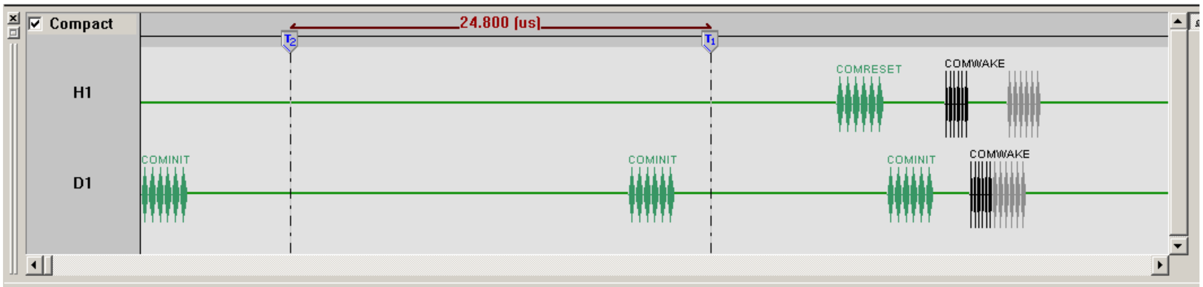

☑ Compact
24.800 (us)
T2
T1
H1
D1
COMRESET
COMWAKE
COMINIT
COMINIT
COMINIT
COMWAKE

Figure 3.46: SATA: Timing Cursors Enabled

Expanded Waveform View

To see a 10x time scale expansion of the waveform, uncheck the **Compact View** checkbox in the Waveform View window. The OOB Sequence has speed negotiation (Hardware version 4 or later).

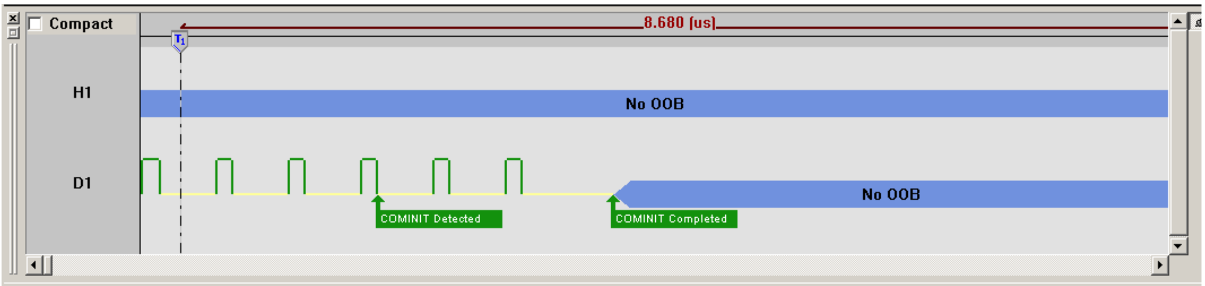


Figure 3.47: SATA: Expanded Waveform View

Performance Reference Definitions

Trp. No. - Number of Transports

The total number of transports that compose this exchange.

Resp. Time - Response Time

The time taken to transmit this command on the link(s) from the beginning of the first frame in the command to the end of the last frame in the command.

Pld. Bytes - Payload Bytes

The number of payload bytes this operation transferred.

Latency Time

The time measured from the transmission of the command to the first data transmitted for this IO operation.

Data-Stat. Time - Data to Status Time

The time between the end of data transmission for this command and the Status frame.

Thrpt MB/s- Data Throughput

The payload divided by response time expressed in MB per second.

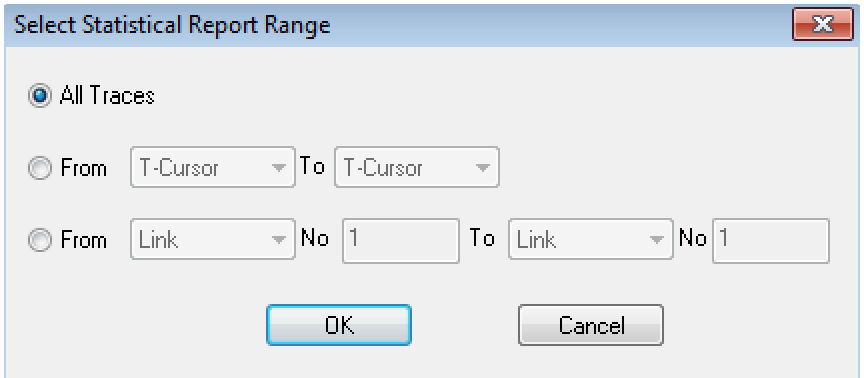
Duration

The time taken from the first DWord to the last DWord in a line.

3.3.11 Statistical Report

Whenever a captured sample is in the Sample Viewer, a **Statistical Report** selection in the **Report** menu and a **Statistical Report Button** on the viewer toolbar are enabled. You can create a Statistical Report for the entire capture or select a portion of it.

To display a Statistical Report, click the **Statistical Report** button on the viewer toolbar or select **Report > Statistical Report** to display the Select Statistical Report Range dialog (see Figure 3.48).



Select Statistical Report Range

● All Traces

○ From T-Cursor To T-Cursor

○ From Link No 1 To Link No 1

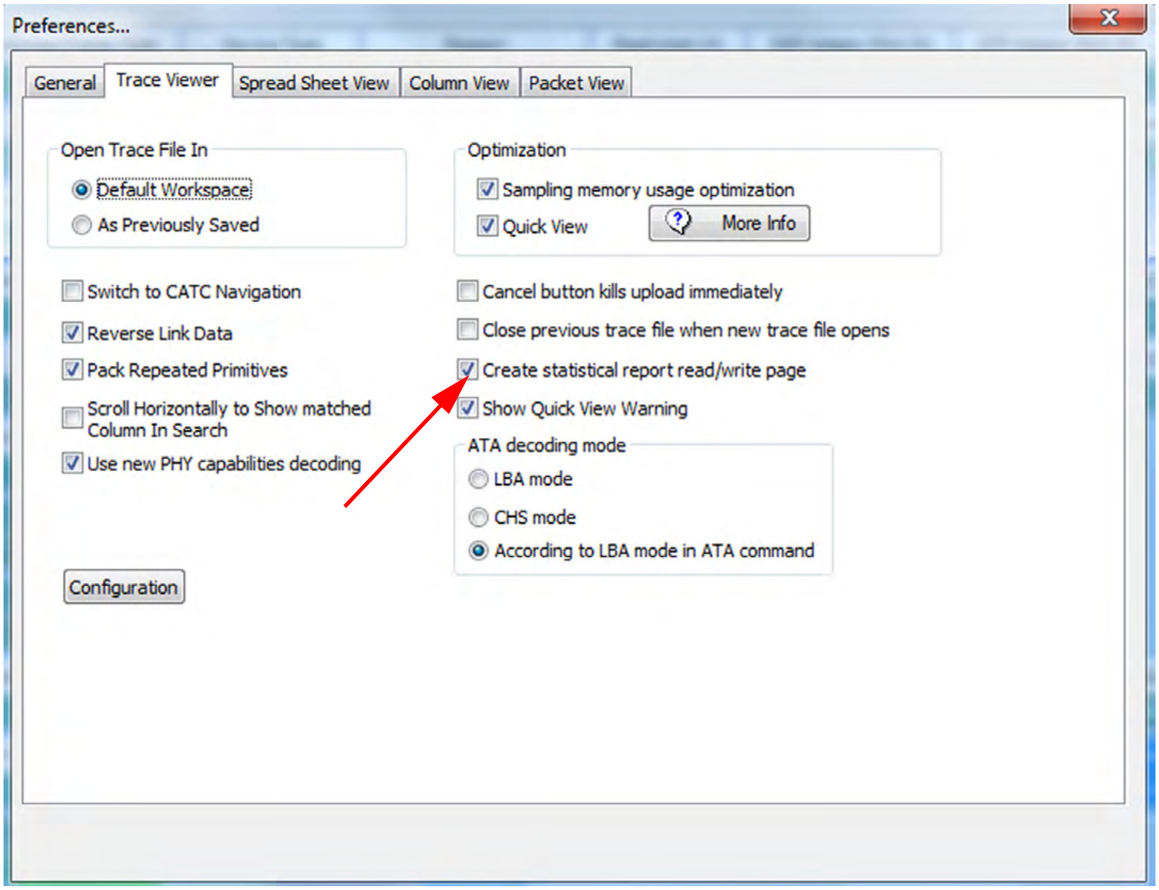
Figure 3.48: Statistical Report Range Dialog.

The default statistical report has All Samples. You can set a specific Statistical report range between defined cursor positions or events.

Generating Statistical Read/Write Report

To create a statistical read/write page perform the following steps:

1. Click on **Setup > Preferences**.
2. Click on the **Trace Viewer** tab.
3. Check the box **Create statistical report read/write page** (see Figure 3.49 on page 153.)



Open Trace File In
● Default Workspace
○ As Previously Saved

Optimization
☑ Sampling memory usage optimization
☑ Quick View

☐ Switch to CATC Navigation
☑ Reverse Link Data
☑ Pack Repeated Primitives
☐ Scroll Horizontally to Show matched Column In Search
☑ Use new PHY capabilities decoding

☐ Cancel button kills upload immediately
☐ Close previous trace file when new trace file opens
☑ Create statistical report read/write page
☑ Show Quick View Warning

ATA decoding mode
○ LBA mode
○ CHS mode
● According to LBA mode in ATA command

Figure 3.49: Enabling Read/Write Statistical Report.

Note: This setting should be enabled before you capture the trace file.

If you have already captured a trace file and want to create a read/write statistical report for the sample, perform the following steps:

1. Enable the read/write settings as mentioned above.
2. Open the trace file.
3. Set the X pointer on the first packet in the viewer.
4. Set the Y pointer on last packet in the viewer.
5. Save as the trace file using the X to Y option.

Now the saved trace file will contain the read/write statistical report.

Report Between Cursors

Click the option button next to the **From** cursor selection drop down list. Then click the **From** down arrow and choose the 1st cursor, click the **To** down arrow to choose the 2nd cursor, and click **OK.** The resulting report has only the capture between the cursors (see Figure 3.50 on page 154).

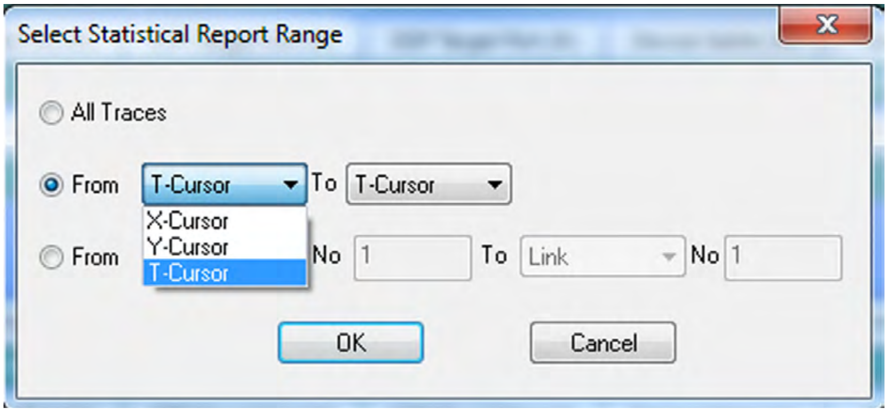

Select Statistical Report Range
All Traces
From
T-Cursor
To
T-Cursor
X-Cursor
Y-Cursor
T-Cursor
From
No
1
To
Link
No
1
OK
Cancel

Figure 3.50: Report between Cursors.

Report Between Events (see Figure 3.51)

1. Click the option button next to the **From** the event selection dropdown list.
2. Click the **From** down arrow to choose the first event. Choose from the following event types:
   - ❑ Link
   - ❑ Transport
   - ❑ ATA Cmd.
   - ❑ SCSI Cmd.
   - ❑ SMP Cmd.
   - ❑ Task Mng.
3. Enter the number of its occurrence.
4. Click the **To** down arrow to choose the second event.
5. Enter the number of its occurrence.

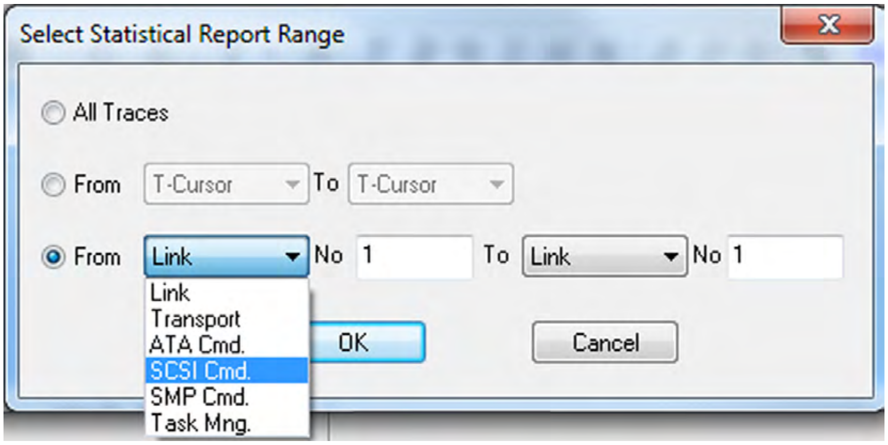
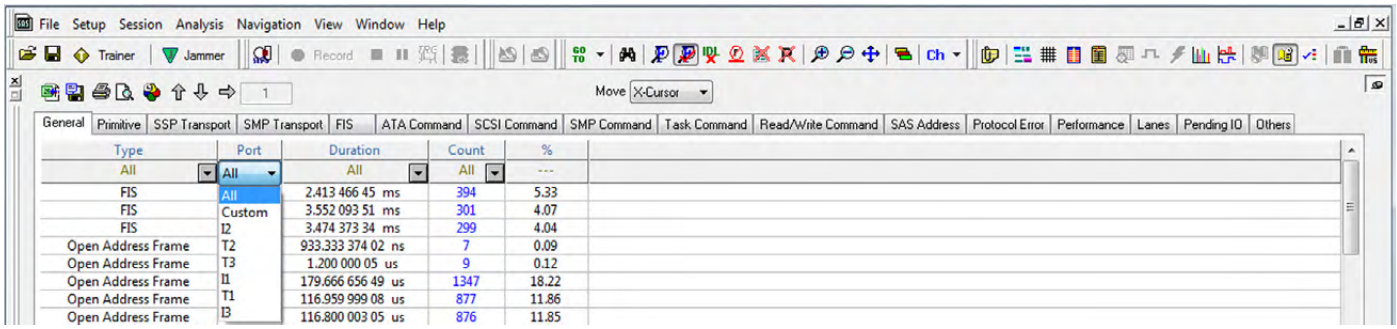

Select Statistical Report Range
All Traces
From
T-Cursor
To
T-Cursor
From
Link
No
1
To
Link
No
1
Link
Transport
ATA Cmd.
SCSI Cmd.
SMP Cmd.
Task Mng.
OK
Cancel

Figure 3.51: Report between Events.

6. Click **OK.** The resulting reports are limited to the capture between the defined events.

Statistical Report Content

A complete statistical report consists of the following reports, accessed by clicking the corresponding tab in the dialog see: Figure 3.52 on page 155.


File
Setup
Session
Analysis
Navigation
View
Window
Help
Trainer
Jammer
Record
GO TO
Ch
1
Move
X-Cursor
General
Primitive
SSP Transport
SMP Transport
FIS
ATA Command
SCSI Command
SMP Command
Task Command
Read/Write Command
SAS Address
Protocol Error
Performance
Lanes
Pending IO
Others
All
Custom
I2
T2
T3
I1
T1
I3

Type	Port	Duration	Count	%
All	All	All	All	---
FIS		2.413 466 45 ms	394	5.33
FIS		3.552 093 51 ms	301	4.07
FIS		3.474 373 34 ms	299	4.04
Open Address Frame		933.333 374 02 ns	7	0.09
Open Address Frame		1.200 000 05 us	9	0.12
Open Address Frame		179.666 656 49 us	1347	18.22
Open Address Frame		116.959 999 08 us	877	11.86
Open Address Frame		116.800 003 05 us	876	11.85

Figure 3.52: Analysis: Statistical Reports Showing Ports

- ❑ General
- ❑ Primitive
- ❑ SSP Transport
- ❑ SMP Transport
- ❑ FIS
- ❑ ATA Command
- ❑ Queue Command
- ❑ ATAPI Command
- ❑ SCSI Command
- ❑ SMP Command
- ❑ Task Command
- ❑ Read/Write Command
- ❑ SAS Address
- ❑ Protocol Error
- ❑ Performance
- ❑ Lanes
- ❑ Pending IO
- ❑ Others

Performance Reference Definitions

Trp. No. - Number of Transports

The total number of transports that compose this exchange.

Resp. Time - Response Time

The time taken to transmit this command on the link(s) from the beginning of the first frame in the command to the end of the last frame in the command.

Pld. Bytes - Payload Bytes

The number of payload bytes this operation transferred.

Latency Time

The time measured from the transmission of the command to the first data transmitted for this IO operation.

Data-Stat. Time - Data to Status Time

The time between the end of data transmission for this command and the Status frame.

Thrpt MB/s- Data Throughput

The payload divided by response time expressed in MB per second.

Duration

The time taken from the first DWord to the last DWord in a line.

Note: Results are displayed only for items that have been captured in the sample.

Report Options

Some report categories offer options which display only specific items. The tabs shown in the examples below depend on the specific Trace loaded. These report categories incorporate drop-down list boxes offering pre-defined and custom options. For details see Formatting the Statistical Report View on page 175.

General Report

To display the General Report, click the **General** tab. The General Report displays the report data in columns with the following information Type of Frame, Port Type, Duration, Count and % (see Figure 3.53).

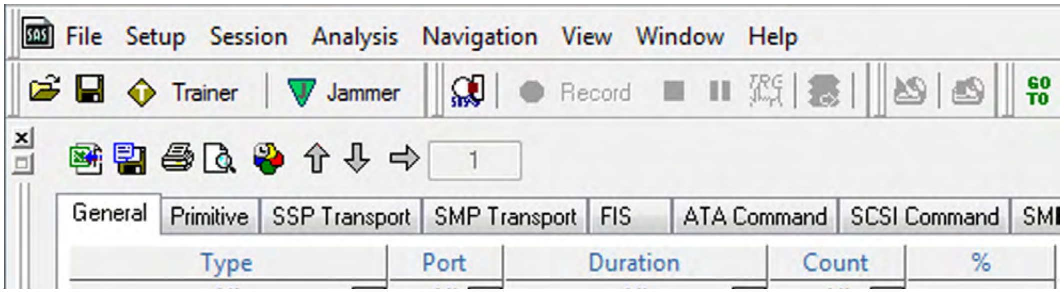
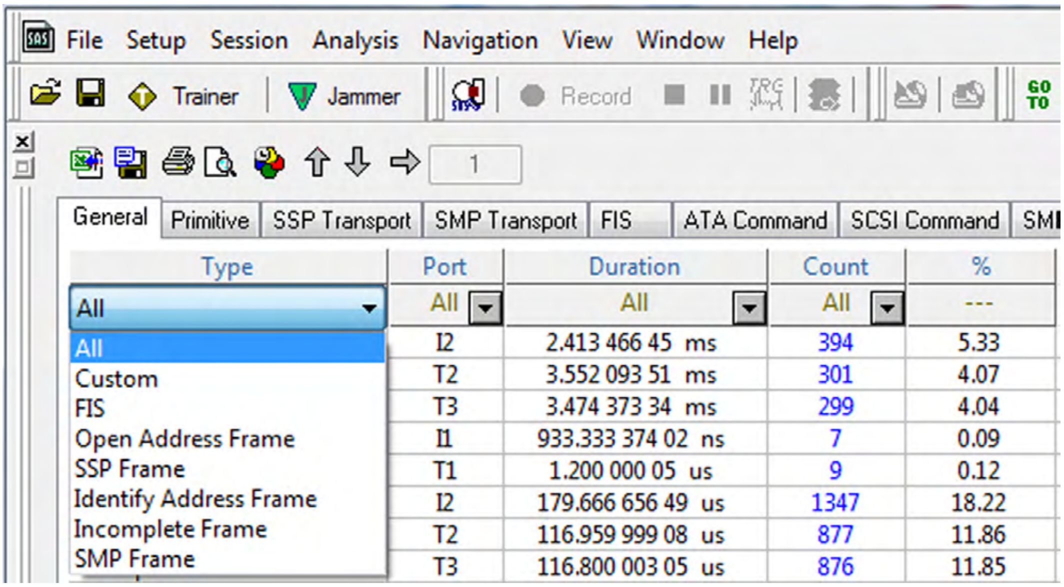

File
Setup
Session
Analysis
Navigation
View
Window
Help
Trainer
Jammer
Record
GO TO
1
General
Primitive
SSP Transport
SMP Transport
FIS
ATA Command
SCSI Command
SMI
Type
Port
Duration
Count
%

Figure 3.53: General Statistical Report.

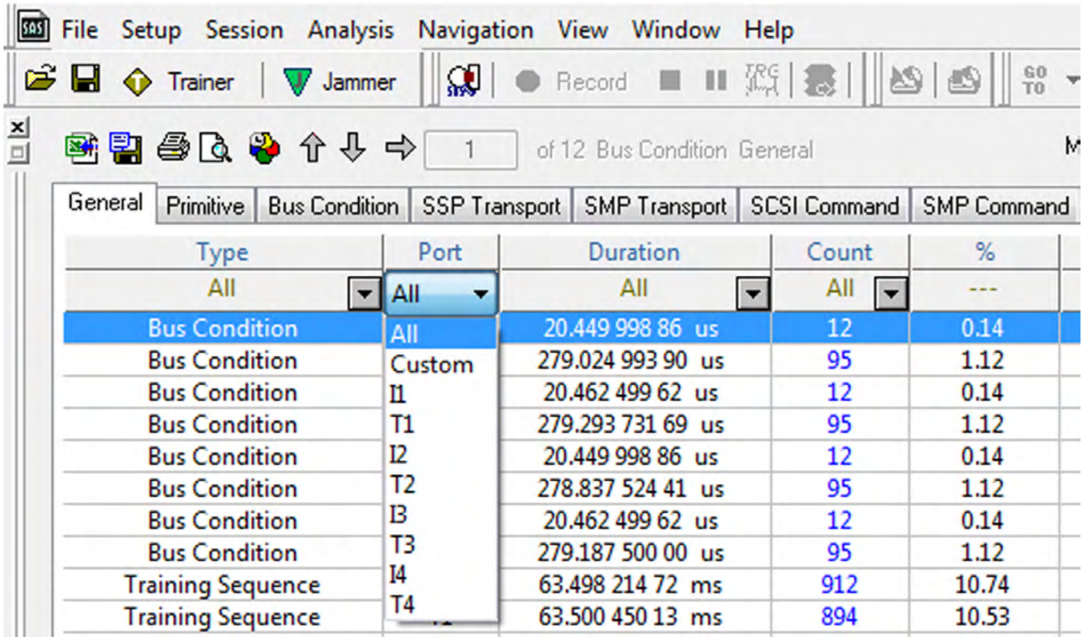
- **Type** contains: All, Custom, FIS, Open Address Frame, SSP Frame, Identify Address Frame, Incomplete Frame and SMP Frame (see Figure 3.54).


File
Setup
Session
Analysis
Navigation
View
Window
Help
Trainer
Jammer
Record
GO TO
1
General
Primitive
SSP Transport
SMP Transport
FIS
ATA Command
SCSI Command
SMI
All
All
Custom
FIS
Open Address Frame
SSP Frame
Identify Address Frame
Incomplete Frame
SMP Frame

Port	Duration	Count	%
All	All	All	---
I2	2.413 466 45 ms	394	5.33
T2	3.552 093 51 ms	301	4.07
T3	3.474 373 34 ms	299	4.04
I1	933.333 374 02 ns	7	0.09
T1	1.200 000 05 us	9	0.12
I2	179.666 656 49 us	1347	18.22
T2	116.959 999 08 us	877	11.86
T3	116.800 003 05 us	876	11.85

Figure 3.54: Statistical Report: General --> Type Descriptions

- **Port**: All, Custom, I1, T1, I2, T2, I3, T3, I4, T4 (see Figure 3.55).


File
Setup
Session
Analysis
Navigation
View
Window
Help
Trainer
Jammer
Record
GO TO
1
of 12 Bus Condition General
General
Primitive
Bus Condition
SSP Transport
SMP Transport
SCSI Command
SMP Command
All
All
Custom
I1
T1
I2
T2
I3
T3
I4
T4

Type	Duration	Count	%
All	All	All	---
Bus Condition	20.449 998 86 us	12	0.14
Bus Condition	279.024 993 90 us	95	1.12
Bus Condition	20.462 499 62 us	12	0.14
Bus Condition	279.293 731 69 us	95	1.12
Bus Condition	20.449 998 86 us	12	0.14
Bus Condition	278.837 524 41 us	95	1.12
Bus Condition	20.462 499 62 us	12	0.14
Bus Condition	279.187 500 00 us	95	1.12
Training Sequence	63.498 214 72 ms	912	10.74
Training Sequence	63.500 450 13 ms	894	10.53

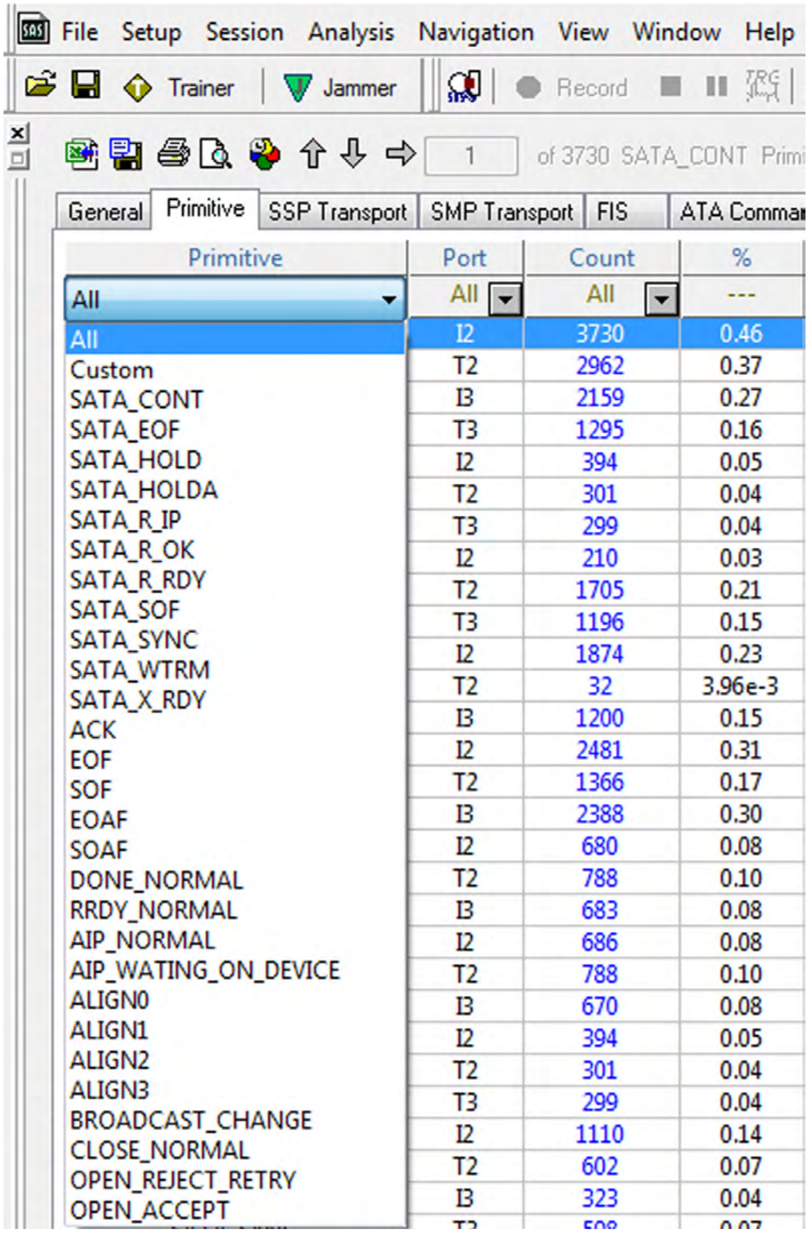
Figure 3.55: Statistical Report: General --> Port

- **Duration**: All, Custom, or time unit
- **Count**: All, Custom, or a number of occurrences
- **%**: Percentage of total count

Primitive Report

To display the Primitive Report, click the **Primitive** tab. The Primitive Report displays information in the following columns:

- **Primitive**: See Figure 3.56 (below)
- **Port**: See Figure 3.55 on page 157 (All, Custom, I1, T1, I2, T2, I3, T3, I4, T4)
- **Count**: All, Custom, or a number of occurrences
- **%**: Percentage of total count


File
Setup
Session
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Navigation
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Trainer
Jammer
Record
1
of 3730 SATA_CONT Primi
General
Primitive
SSP Transport
SMP Transport
FIS
ATA Comma
Primitive
All
All
Custom
SATA_CONT
SATA_EOF
SATA_HOLD
SATA_HOLDA
SATA_R_IP
SATA_R_OK
SATA_R_RDY
SATA_SOF
SATA_SYNC
SATA_WTRM
SATA_X_RDY
ACK
EOF
SOF
EOAF
SOAF
DONE_NORMAL
RRDY_NORMAL
AIP_NORMAL
AIP_WATING_ON_DEVICE
ALIGN0
ALIGN1
ALIGN2
ALIGN3
BROADCAST_CHANGE
CLOSE_NORMAL
OPEN_REJECT_RETRY
OPEN_ACCEPT

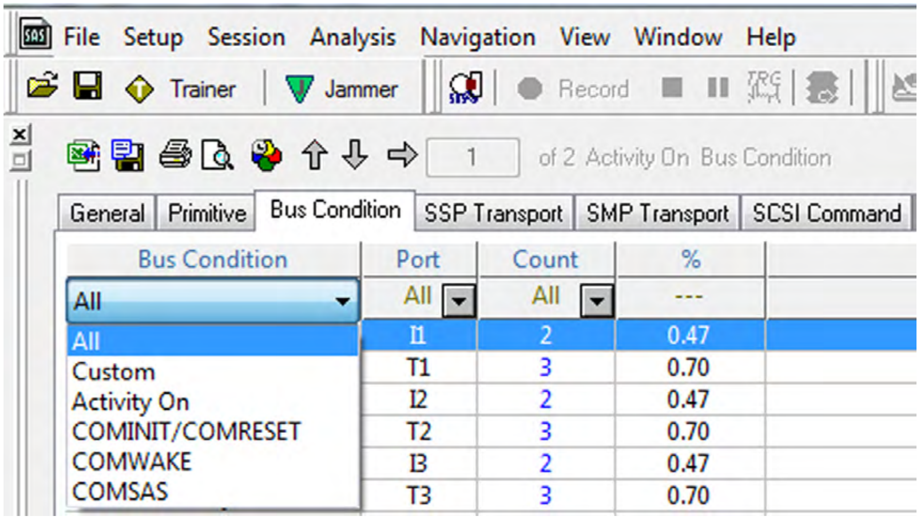
Port	Count	%
All	All	---
I2	3730	0.46
T2	2962	0.37
I3	2159	0.27
T3	1295	0.16
I2	394	0.05
T2	301	0.04
T3	299	0.04
I2	210	0.03
T2	1705	0.21
T3	1196	0.15
I2	1874	0.23
T2	32	3.96e-3
I3	1200	0.15
I2	2481	0.31
T2	1366	0.17
I3	2388	0.30
I2	680	0.08
T2	788	0.10
I3	683	0.08
I2	686	0.08
T2	788	0.10
I3	670	0.08
I2	394	0.05
T2	301	0.04
T3	299	0.04
I2	1110	0.14
T2	602	0.07
I3	323	0.04

Figure 3.56: Statistical Report: Primitive.

Bus Condition Report

To display the Bus Condition Report, click the **Bus Condition** tab. The Bus Condition Report displays information in the following columns:

- **Bus Condition**: See Figure 3.57 (All, Custom, Activity On, COMINIT/COMRESET, COMWAKE, COMSAS)
- **Port**: See Figure 3.55 on page 157 (All, Custom, I1, T1, I2, T2, I3, T3, I4, T4)
- **Count**: All, Custom, or a number of occurrences
- **%**: Percentage of total count


File
Setup
Session
Analysis
Navigation
View
Window
Help
Trainer
Jammer
Record
1
of 2 Activity On Bus Condition
General
Primitive
Bus Condition
SSP Transport
SMP Transport
SCSI Command
All
Custom
Activity On
COMINIT/COMRESET
COMWAKE
COMSAS

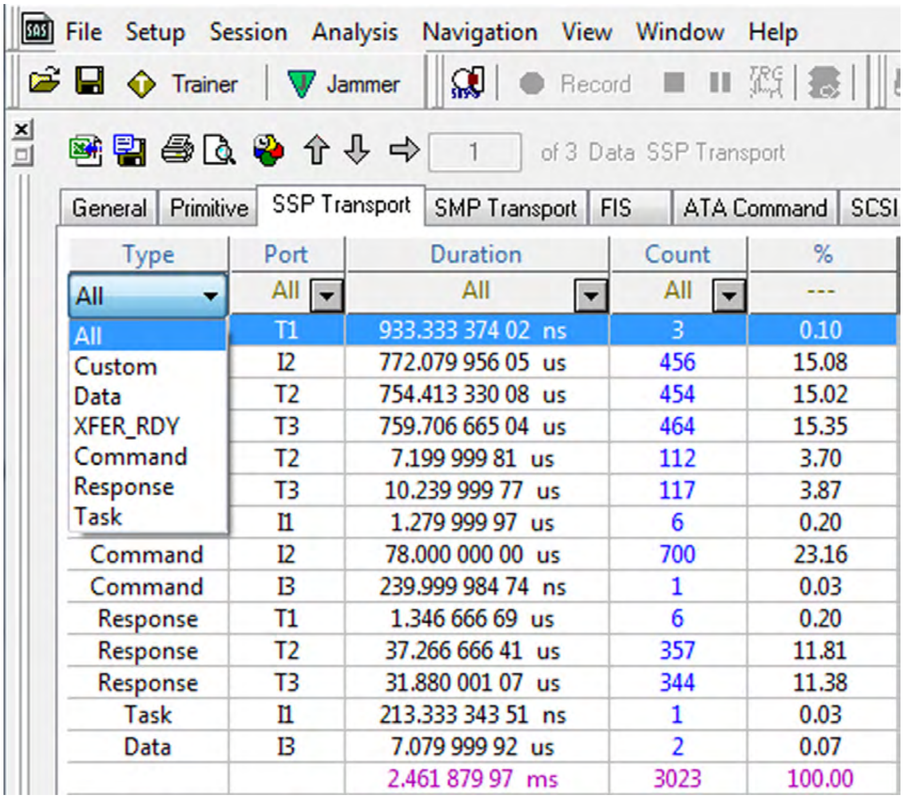
Bus Condition	Port	Count	%
All	All	All	---
	I1	2	0.47
	T1	3	0.70
	I2	2	0.47
	T2	3	0.70
	I3	2	0.47
	T3	3	0.70

Figure 3.57: Statistical Reports: Bus Condition

SSP Transport Report

To display the SSP Transport Report, click the **SSP Transport** tab. The SSP Transport Report displays information in the following columns.

- **Type**: See Figure 3.58 on page 160 (All, Custom, Data, XFR_RDY, Command, Response and Task)
- **Port**: See Figure 3.55 on page 157 (All, Custom, I1, T1, I2, T2, I3, T3, I4, T4)
- **Duration**: All, Custom, or time unit
- **Count**: All, Custom, or a number of occurrences
- **%**: Percentage of total count


File
Setup
Session
Analysis
Navigation
View
Window
Help
Trainer
Jammer
Record
1
of 3 Data SSP Transport
General
Primitive
SSP Transport
SMP Transport
FIS
ATA Command
SCSI
All
Custom
Data
XFER_RDY
Command
Response
Task

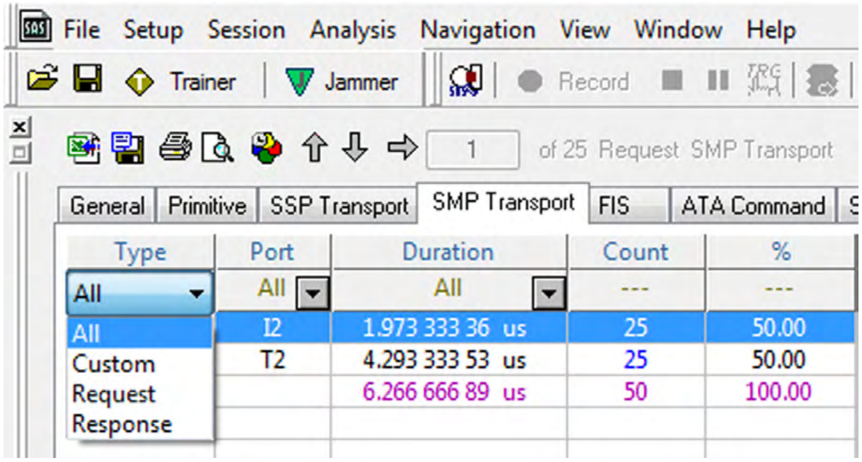
Type	Port	Duration	Count	%
All	All	All	All	---
	T1	933.333 374 02 ns	3	0.10
	I2	772.079 956 05 us	456	15.08
	T2	754.413 330 08 us	454	15.02
	T3	759.706 665 04 us	464	15.35
	T2	7.199 999 81 us	112	3.70
	T3	10.239 999 77 us	117	3.87
	I1	1.279 999 97 us	6	0.20
Command	I2	78.000 000 00 us	700	23.16
Command	I3	239.999 984 74 ns	1	0.03
Response	T1	1.346 666 69 us	6	0.20
Response	T2	37.266 666 41 us	357	11.81
Response	T3	31.880 001 07 us	344	11.38
Task	I1	213.333 343 51 ns	1	0.03
Data	I3	7.079 999 92 us	2	0.07
		2.461 879 97 ms	3023	100.00

Figure 3.58: Statistical Reports: SSP Transport.

SMP Transport Report

To display the SMP Transport Report, click the **SMP Transport** tab. The SMP Transport Report displays information in the following columns.

- **Types**: See Figure 3.59 (All, Custom, Request, Response)
- **Port**: See Figure 3.55 on page 157 (All, Custom, I1, T1, I2, T2, I3, T3, I4, T4)
- **Duration**: All, Custom, or time unit
- **Count**: All, Custom, or a number of occurrences
- **%**: Percentage of total count


File
Setup
Session
Analysis
Navigation
View
Window
Help
Trainer
Jammer
Record
1
of 25 Request SMP Transport
General
Primitive
SSP Transport
SMP Transport
FIS
ATA Command
All
Custom
Request
Response

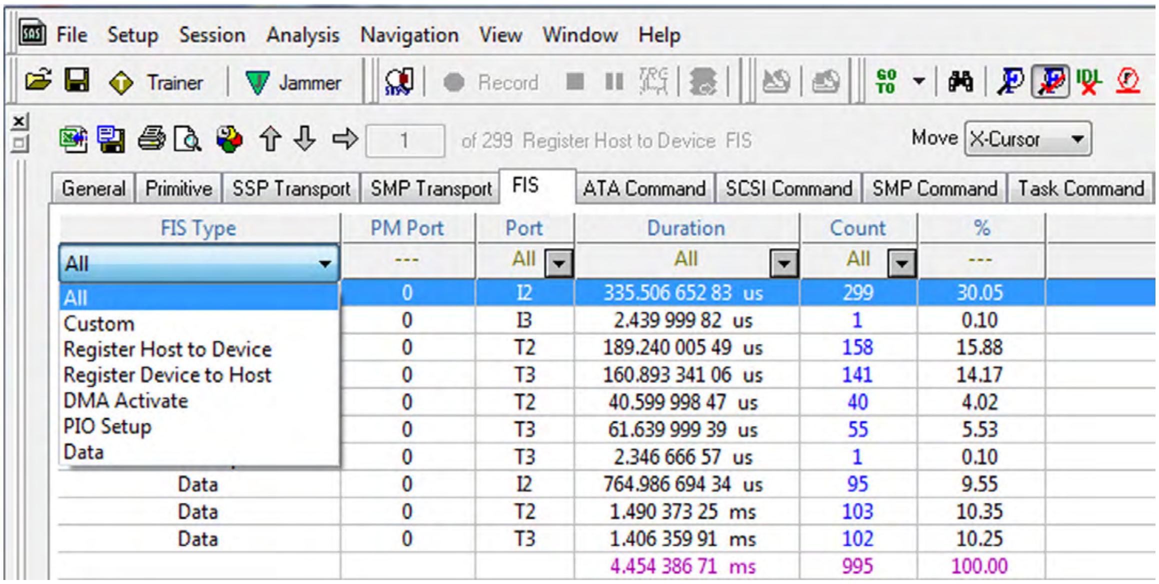
Type	Port	Duration	Count	%
All	All	All	---	---
	I2	1.973 333 36 us	25	50.00
	T2	4.293 333 53 us	25	50.00
		6.266 666 89 us	50	100.00

Figure 3.59: SMP Transport Report

FIS Command Report

To display the FIS Command Report, click the **FIS Command** tab (see Figure 3.60). The FIS Command Report displays information in the following columns:

- **FIS Types**: All, Custom, Register Host to Device, Register Device to Host, DMA Active, PIO Setup and Data
- **Port**: See Figure 3.55 on page 157 (All, Custom, I1, T1, I2, T2, I3, T3, I4, T4)
- **Count**: All, Custom, or a number of occurrences
- **%**: Percentage of total count


File
Setup
Session
Analysis
Navigation
View
Window
Help
Trainer
Jammer
Record
GO TO
1
of 299 Register Host to Device FIS
Move
X-Cursor
General
Primitive
SSP Transport
SMP Transport
FIS
ATA Command
SCSI Command
SMP Command
Task Command
All
Custom
Register Host to Device
Register Device to Host
DMA Activate
PIO Setup
Data

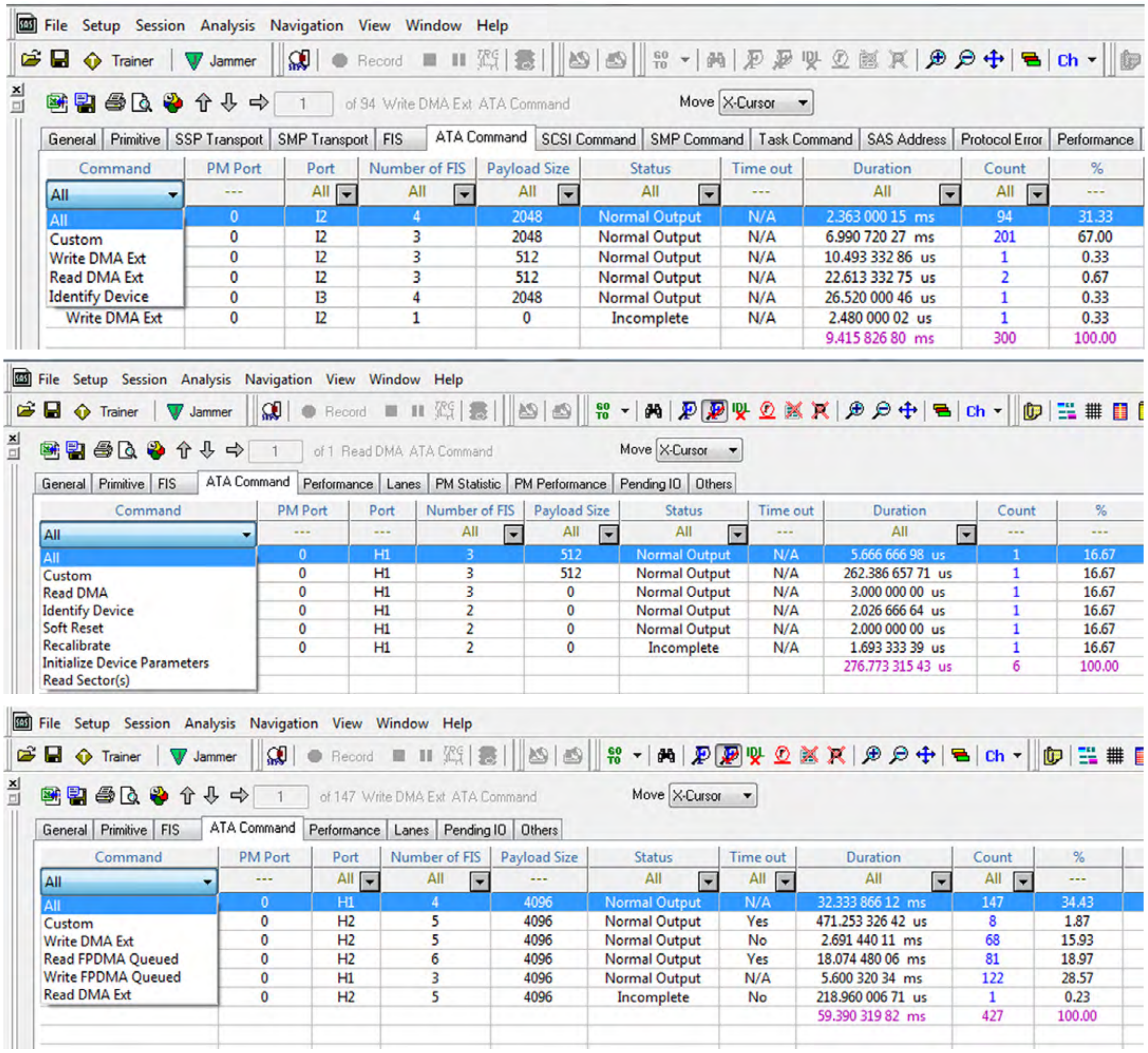
FIS Type	PM Port	Port	Duration	Count	%
All	---	All	All	All	---
	0	I2	335.506 652 83 us	299	30.05
	0	I3	2.439 999 82 us	1	0.10
	0	T2	189.240 005 49 us	158	15.88
	0	T3	160.893 341 06 us	141	14.17
	0	T2	40.599 998 47 us	40	4.02
	0	T3	61.639 999 39 us	55	5.53
	0	T3	2.346 666 57 us	1	0.10
Data	0	I2	764.986 694 34 us	95	9.55
Data	0	T2	1.490 373 25 ms	103	10.35
Data	0	T3	1.406 359 91 ms	102	10.25
			4.454 386 71 ms	995	100.00

Figure 3.60: Statistical Reports: FIS Type

ATA Command Report

To display the ATA Command Report, click the **ATA Command** tab (see Figure 3.61 on page 163). The ATA Command Report displays information in the following columns:

- **Command**: All, Custom, Check Power Mode, Execute Device Diagnostic, Flush Cache, Identify Device, Read DMA Ext, Read FPDMA Queue, Set Feature, Write DMA Ext, Write FPDMA Queue
- PM Port
- **Port**: All, H1, I1, H2, I2, H3, I3, H4, I4, or Custom
- **Number of FIS**: All, Custom, or a number
- **Payload Size**: All, Custom, or a number of DWORDs
- **Status**: All, Custom, Incomplete, Normal Output
- **Timeout**: All, Custom, N/A, Yes, No (see Time out of ATA Command Report on page 163)
- **Duration**: All, Custom, or time unit
- **Count**: All, Custom, or a number of occurrences
- **%**: Percentage of total count


File Setup Session Analysis Navigation View Window Help
Trainer
Jammer
Record
Ch
1
of 94 Write DMA Ext ATA Command
Move X-Cursor
General Primitive SSP Transport SMP Transport FIS ATA Command SCSI Command SMP Command Task Command SAS Address Protocol Error Performance
All
Custom
Write DMA Ext
Read DMA Ext
Identify Device

Command	PM Port	Port	Number of FIS	Payload Size	Status	Time out	Duration	Count	%
All	---	All	All	All	All	---	All	All	---
	0	I2	4	2048	Normal Output	N/A	2.363 000 15 ms	94	31.33
	0	I2	3	2048	Normal Output	N/A	6.990 720 27 ms	201	67.00
	0	I2	3	512	Normal Output	N/A	10.493 332 86 us	1	0.33
	0	I2	3	512	Normal Output	N/A	22.613 332 75 us	2	0.67
	0	I3	4	2048	Normal Output	N/A	26.520 000 46 us	1	0.33
Write DMA Ext	0	I2	1	0	Incomplete	N/A	2.480 000 02 us	1	0.33
							9.415 826 80 ms	300	100.00

File Setup Session Analysis Navigation View Window Help
Trainer
Jammer
Record
Ch
1
of 1 Read DMA ATA Command
Move X-Cursor
General Primitive FIS ATA Command Performance Lanes PM Statistic PM Performance Pending IO Others
All
Custom
Read DMA
Identify Device
Soft Reset
Recalibrate
Initialize Device Parameters
Read Sector(s)

Command	PM Port	Port	Number of FIS	Payload Size	Status	Time out	Duration	Count	%
All	---	---	All	All	All	---	All	---	---
	0	H1	3	512	Normal Output	N/A	5.666 666 98 us	1	16.67
	0	H1	3	512	Normal Output	N/A	262.386 657 71 us	1	16.67
	0	H1	3	0	Normal Output	N/A	3.000 000 00 us	1	16.67
	0	H1	2	0	Normal Output	N/A	2.026 666 64 us	1	16.67
	0	H1	2	0	Normal Output	N/A	2.000 000 00 us	1	16.67
	0	H1	2	0	Incomplete	N/A	1.693 333 39 us	1	16.67
							276.773 315 43 us	6	100.00

File Setup Session Analysis Navigation View Window Help
Trainer
Jammer
Record
Ch
1
of 147 Write DMA Ext ATA Command
Move X-Cursor
General Primitive FIS ATA Command Performance Lanes Pending IO Others
All
Custom
Write DMA Ext
Read FPDMA Queued
Write FPDMA Queued
Read DMA Ext

Command	PM Port	Port	Number of FIS	Payload Size	Status	Time out	Duration	Count	%
All	---	All	All	---	All	All	All	All	---
	0	H1	4	4096	Normal Output	N/A	32.333 866 12 ms	147	34.43
	0	H2	5	4096	Normal Output	Yes	471.253 326 42 us	8	1.87
	0	H2	5	4096	Normal Output	No	2.691 440 11 ms	68	15.93
	0	H2	6	4096	Normal Output	Yes	18.074 480 06 ms	81	18.97
	0	H1	3	4096	Normal Output	N/A	5.600 320 34 ms	122	28.57
	0	H2	5	4096	Incomplete	No	218.960 006 71 us	1	0.23
							59.390 319 82 ms	427	100.00

Figure 3.61: Statistical Reports: ATA Command Report from Three Different Traces

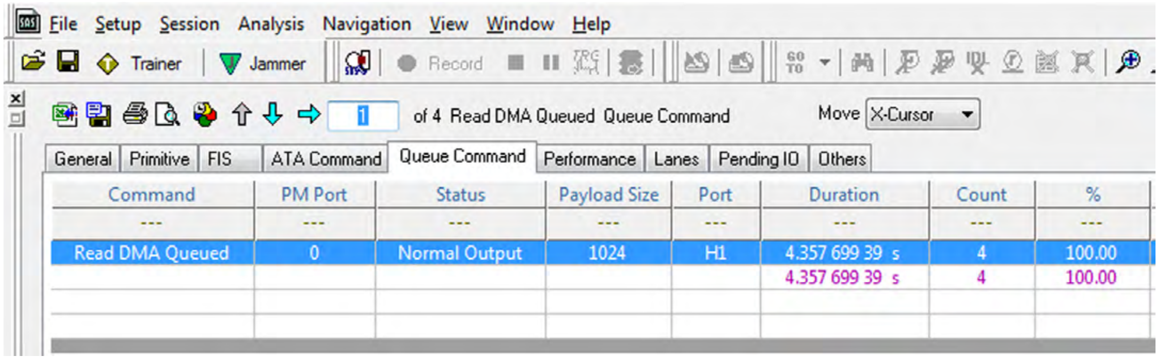
Time out of ATA Command Report

The Time out shows the NCQ time out. It is applicable for only NCQ commands. A threshold can be set in the "NCQ commands Timeout Threshold", the default value is 1000 µsec (the user can change it to any value). The statistical report provides a "Time out" report based on this threshold. Any NCQ command that takes more than the given threshold is flagged as "yes", which means that a timeout occurred for that command.

Queue Command Report

To display the Queue Command Report, click the **Queue Command** tab (see Figure 3.62 on page 164). The SMP Transport Report displays information in the following columns.

- **Command:** Read DMA Queued
- PM Port:
- **Status:** Normal Output
- **Payload Size:** Number
- **Port:** All, H1, I1, H2, I2, H3, I3, H4, I4, or Custom
- **Duration**: All, Custom, or time unit
- **Count**: All, Custom, or a number of occurrences
- **%**: Percentage of total count


File
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Navigation
View
Window
Help
Trainer
Jammer
Record
1
of 4 Read DMA Queued Queue Command
Move
X-Cursor
General
Primitive
FIS
ATA Command
Queue Command
Performance
Lanes
Pending IO
Others

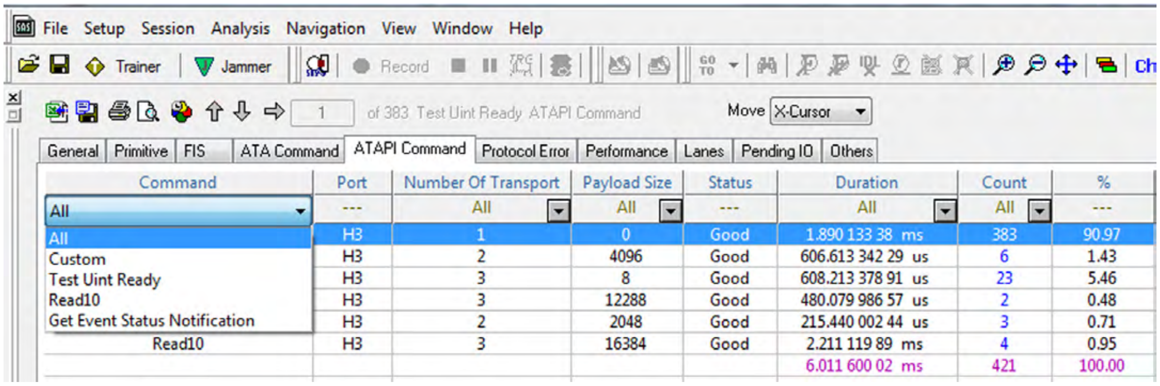
Command	PM Port	Status	Payload Size	Port	Duration	Count	%
---	---	---	---	---	---	---	---
Read DMA Queued	0	Normal Output	1024	H1	4.357 699 39 s	4	100.00
					4.357 699 39 s	4	100.00

Figure 3.62: Statistical Reports: Queue Commands

ATAPI Command Report

To display the ATAPI Report (see Figure 3.63), click the **ATAPI** tab. The ATAPI Report displays information in the following columns:

- **Command**: All, Custom, Inquiry, Mode Sense 10, Read10, Request Sense, Test Unit Ready, Get Event Status Notification
- **Port**: All, H1, I1, H2, I2, H3, I3, H4, I4, or Custom
- **Number of Transport**: All, Custom, or a number
- **Payload Size**: All, Custom, or a number of DWORDs
- **Status**: All, Custom, Check Condition, Good
- **Duration**: All, Custom, or time unit (accumulative)
- **Count**: All, Custom, or a number of occurrences
- **%:** Percentage of total count


File Setup Session Analysis Navigation View Window Help
Trainer
Jammer
Record
Ch
1
of 383 Test Uint Ready ATAPI Command
Move X-Cursor
General Primitive FIS ATA Command ATAPI Command Protocol Error Performance Lanes Pending IO Others
All
All
Custom
Test Uint Ready
Read10
Get Event Status Notification

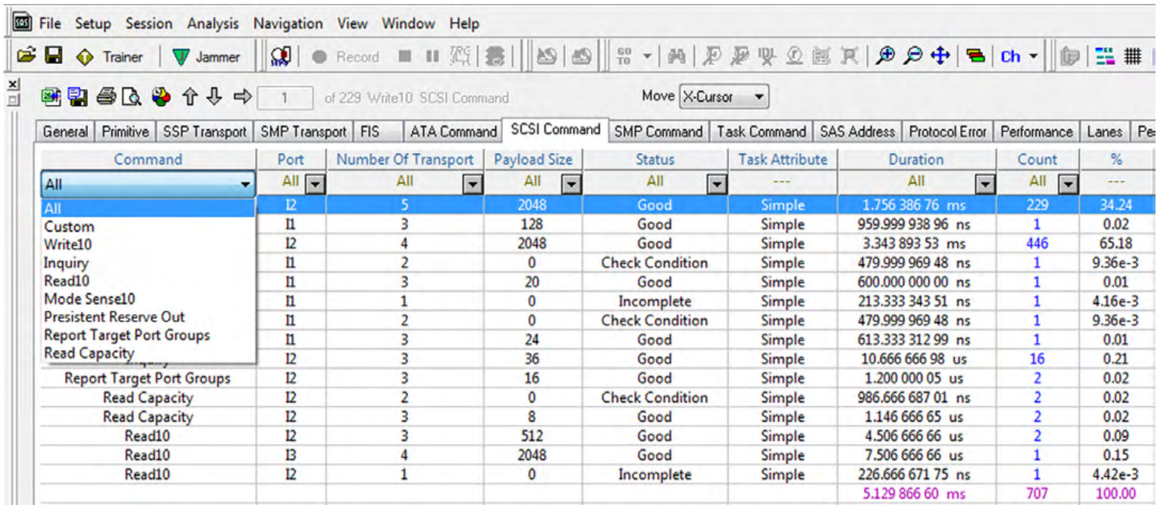
Command	Port	Number Of Transport	Payload Size	Status	Duration	Count	%
All	---	All	All	---	All	All	---
	H3	1	0	Good	1.890 133 38 ms	383	90.97
	H3	2	4096	Good	606.613 342 29 us	6	1.43
	H3	3	8	Good	608.213 378 91 us	23	5.46
	H3	3	12288	Good	480.079 986 57 us	2	0.48
	H3	2	2048	Good	215.440 002 44 us	3	0.71
Read10	H3	3	16384	Good	2.211 119 89 ms	4	0.95
					6.011 600 02 ms	421	100.00

Figure 3.63: Statistical Reports: ATAPI Report.

SCSI Command Report

To display the SCSI Command Report (see Figure 3.64 on page 165), click the **SCSI Command** tab. The SCSI Command Report displays information in the following columns:

- **Command**: All, Custom, Write 10, Inquiry, Read 10, Mode Sense 10, Persistent Reserve Out, Report Target Port Groups, Read Capacity, Test Unit Ready
- **Port**: All, H1, I1, H2, I2, H3, I3, H4, I4, or Custom
- **Number of Transport**: All, Custom, or a number
- **Payload Size**: All, Custom, or a number of DWORDs
- **Status**: All, Custom, Check Condition, Good
- **Task Attribute**: Simple
- **Duration**: All, Custom, or time unit (accumulative)
- **Count**: All, Custom, or a number of occurrences
- **%:** Percentage of total count


File Setup Session Analysis Navigation View Window Help
Trainer
Jammer
Record
Ch
1
of 229 Write10 SCSI Command
Move X-Cursor
General Primitive SSP Transport SMP Transport FIS ATA Command SCSI Command SMP Command Task Command SAS Address Protocol Error Performance Lanes Pe
All
All
Custom
Write10
Inquiry
Read10
Mode Sense10
Presistent Reserve Out
Report Target Port Groups
Read Capacity

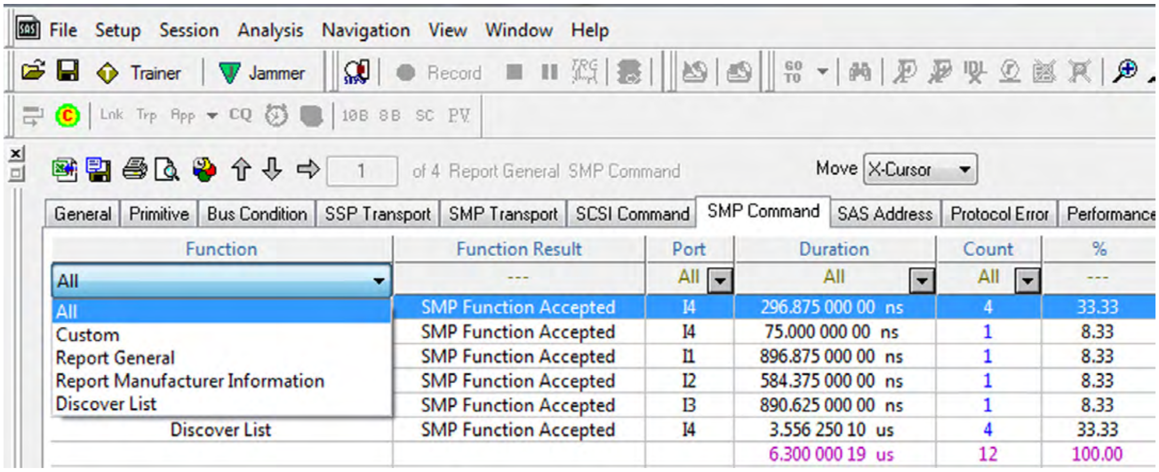
Command	Port	Number Of Transport	Payload Size	Status	Task Attribute	Duration	Count	%
All	All	All	All	All	---	All	All	---
	I2	5	2048	Good	Simple	1.756 386 76 ms	229	34.24
	I1	3	128	Good	Simple	959.999 938 96 ns	1	0.02
	I2	4	2048	Good	Simple	3.343 893 53 ms	446	65.18
	I1	2	0	Check Condition	Simple	479.999 969 48 ns	1	9.36e-3
	I1	3	20	Good	Simple	600.000 000 00 ns	1	0.01
	I1	1	0	Incomplete	Simple	213.333 343 51 ns	1	4.16e-3
	I1	2	0	Check Condition	Simple	479.999 969 48 ns	1	9.36e-3
	I1	3	24	Good	Simple	613.333 312 99 ns	1	0.01
	I2	3	36	Good	Simple	10.666 666 98 us	16	0.21
Report Target Port Groups	I2	3	16	Good	Simple	1.200 000 05 us	2	0.02
Read Capacity	I2	2	0	Check Condition	Simple	986.666 687 01 ns	2	0.02
Read Capacity	I2	3	8	Good	Simple	1.146 666 65 us	2	0.02
Read10	I2	3	512	Good	Simple	4.506 666 66 us	2	0.09
Read10	I3	4	2048	Good	Simple	7.506 666 66 us	1	0.15
Read10	I2	1	0	Incomplete	Simple	226.666 671 75 ns	1	4.42e-3
						5.129 866 60 ms	707	100.00

Figure 3.64: Statistical Reports: SCSI Command

SMP Command Report

To display the SMP Command Report (see Figure 3.65 on page 166), click the **SMP Command** tab. The SMP Command Report displays information in the following columns:

- **Function**: All, Custom, Report General, Report Manufacturer Information, Discover List
- **Port**: All, H1, I1, H2, I2, H3, I3, H4, I4, or Custom
- **Number of Transport**: All, Custom, or a number
- **Payload Size**: All, Custom, or a number of DWORDs
- **Status**: All, Custom, Check Condition, Good
- **Task Attribute**: Simple
- **Duration**: All, Custom, or time unit (accumulative)
- **Count**: All, Custom, or a number of occurrences
- **%:** Percentage of total count


File
Setup
Session
Analysis
Navigation
View
Window
Help
Trainer
Jammer
Record
Lnk
Trp
App
CQ
10B
8B
SC
PV
1
of 4 Report General SMP Command
Move
X-Cursor
General
Primitive
Bus Condition
SSP Transport
SMP Transport
SCSI Command
SMP Command
SAS Address
Protocol Error
Performance
All
All
Custom
Report General
Report Manufacturer Information
Discover List

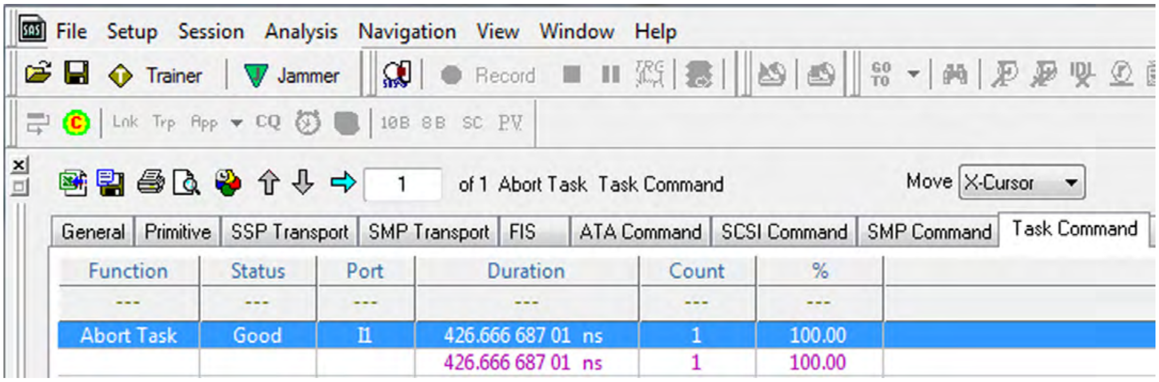
Function	Function Result	Port	Duration	Count	%
All	---	All	All	All	---
	SMP Function Accepted	I4	296.875 000 00 ns	4	33.33
	SMP Function Accepted	I4	75.000 000 00 ns	1	8.33
	SMP Function Accepted	I1	896.875 000 00 ns	1	8.33
	SMP Function Accepted	I2	584.375 000 00 ns	1	8.33
	SMP Function Accepted	I3	890.625 000 00 ns	1	8.33
Discover List	SMP Function Accepted	I4	3.556 250 10 us	4	33.33
			6.300 000 19 us	12	100.00

Figure 3.65: Statistical Reports: SMP Command

Task Command Report

To display the Task Command Report, click the **Task Command** tab (see Figure 3.66). The Task Command Report displays the report data in columns with the following information:

- **Function**: All, Custom, Abort Task
- **Status**: Good
- **Port**: All, H1, I1, H2, I2, H3, I3, H4, I4, or Custom
- **Duration**: All, Custom, or time unit (accumulative)
- **Count**: All, Custom, or a number of occurrences
- **%:** Percentage of total count


File Setup Session Analysis Navigation View Window Help
Trainer
Jammer
Record
Lnk Trp App CQ
10B 8B SC PV
1
of 1 Abort Task Task Command
Move X-Cursor
General Primitive SSP Transport SMP Transport FIS ATA Command SCSI Command SMP Command Task Command

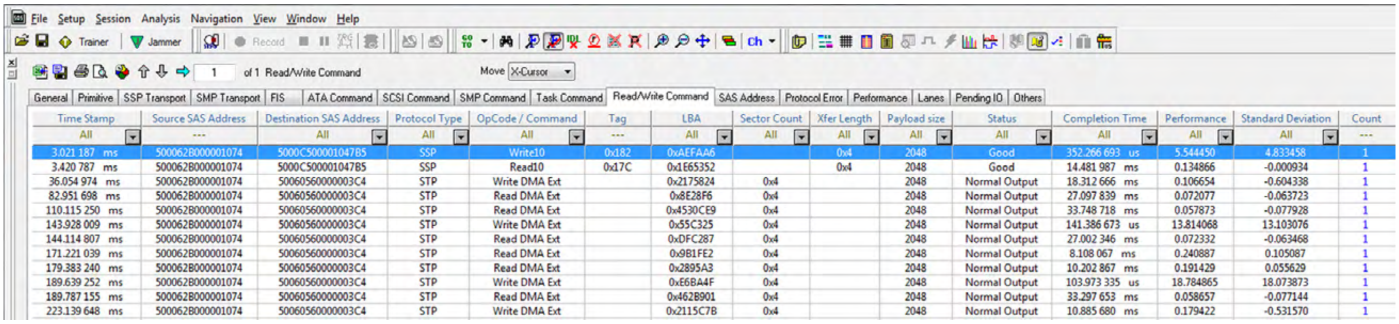
Function	Status	Port	Duration	Count	%
---	---	---	---	---	---
Abort Task	Good	I1	426.666 687 01 ns	1	100.00
			426.666 687 01 ns	1	100.00

Figure 3.66: Statistical Reports: Task Commands

Read/Write Command Report

To display the Read/Write Command Report, click the **Read/Write Command** tab (see Figure 3.67 on page 167).The Read/Write Report displays the report data in columns with the following information:

- **Time Stamp**: All, Custom, Number
- **Source SAS Address**: All, Custom, Number
- **Destination SAS Address**: All, Custom, Number
- **Protocol Type**: All, Custom SSP, STP
- **OpCode/Command**: All, Custom, Read10, Write10, Write DMA Ext, Read DMA Ext, Identify Device
- **Tag**: All, Custom
- **LBA**: All, Custom
- **Sector Count**: All, Custom, Number
- **Xfer Length**: All, Custom, Number
- **Payload Size**: All, Custom, Number
- **Status:** All, Custom, Good, Normal Output, Incomplete
- **Completion Time**: All, Custom, Number
- **Performance**: All, Custom, Number
- **Standard Deviation**: All, Custom, Number
- **Count**: Number


File Setup Session Analysis Navigation View Window Help
Trainer
Jammer
Record
Ch
1
of 1 Read/Write Command
Move X-Cursor
General Primitive SSP Transport SMP Transport FIS ATA Command SCSI Command SMP Command Task Command Read/Write Command SAS Address Protocol Error Performance Lanes Pending IO Others

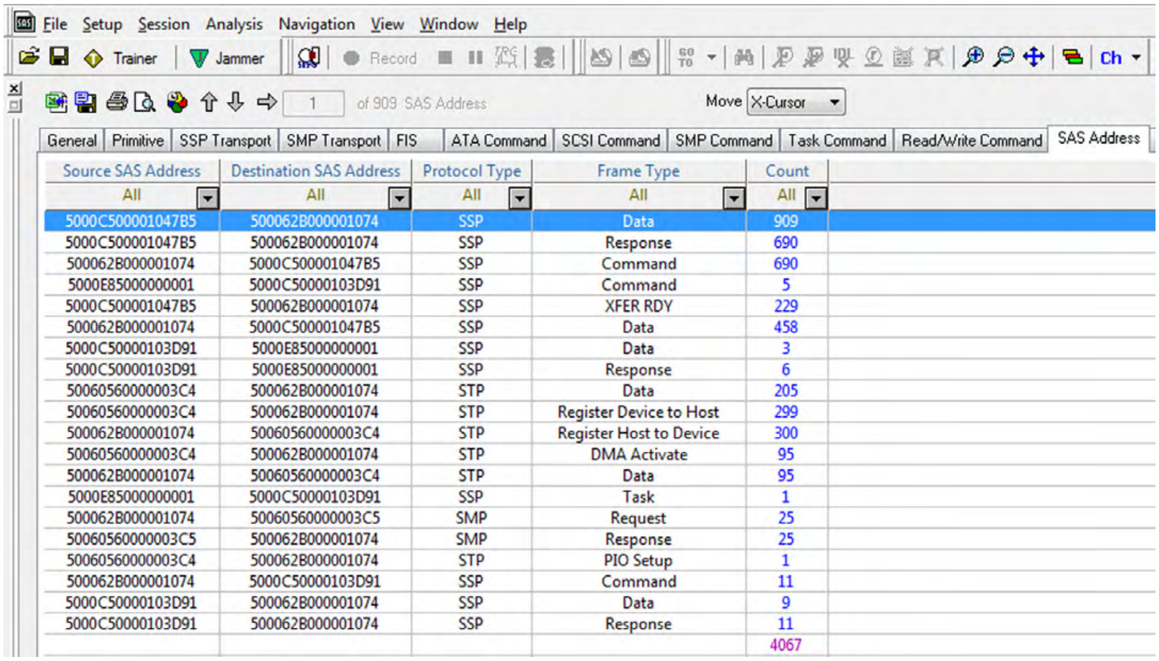
Time Stamp	Source SAS Address	Destination SAS Address	Protocol Type	OpCode / Command	Tag	LBA	Sector Count	Xfer Length	Payload size	Status	Completion Time	Performance	Standard Deviation	Count
All	---	All	All	All	---	All	All	All	All	All	All	All	All	---
3.021 187 ms	500062B000001074	5000C500001047B5	SSP	Write10	0x182	0xAEFAA6		0x4	2048	Good	352.266 693 us	5.544450	4.833458	1
3.420 787 ms	500062B000001074	5000C500001047B5	SSP	Read10	0x17C	0x1E65352		0x4	2048	Good	14.481 987 ms	0.134866	-0.000934	1
36.054 974 ms	500062B000001074	50060560000003C4	STP	Write DMA Ext		0x2175824	0x4		2048	Normal Output	18.312 666 ms	0.106654	-0.604338	1
82.951 698 ms	500062B000001074	50060560000003C4	STP	Read DMA Ext		0x8E28F6	0x4		2048	Normal Output	27.097 839 ms	0.072077	-0.063723	1
110.115 250 ms	500062B000001074	50060560000003C4	STP	Read DMA Ext		0x4530CE9	0x4		2048	Normal Output	33.748 718 ms	0.057873	-0.077928	1
143.928 009 ms	500062B000001074	50060560000003C4	STP	Write DMA Ext		0x55C325	0x4		2048	Normal Output	141.386 673 us	13.814068	13.103076	1
144.114 807 ms	500062B000001074	50060560000003C4	STP	Read DMA Ext		0xDFC287	0x4		2048	Normal Output	27.002 346 ms	0.072332	-0.063468	1
171.221 039 ms	500062B000001074	50060560000003C4	STP	Read DMA Ext		0x9B1FE2	0x4		2048	Normal Output	8.108 067 ms	0.240887	0.105087	1
179.383 240 ms	500062B000001074	50060560000003C4	STP	Read DMA Ext		0x2895A3	0x4		2048	Normal Output	10.202 867 ms	0.191429	0.055629	1
189.639 252 ms	500062B000001074	50060560000003C4	STP	Write DMA Ext		0xE6BA4F	0x4		2048	Normal Output	103.973 335 us	18.784865	18.073873	1
189.787 155 ms	500062B000001074	50060560000003C4	STP	Read DMA Ext		0x462B901	0x4		2048	Normal Output	33.297 653 ms	0.058657	-0.077144	1
223.139 648 ms	500062B000001074	50060560000003C4	STP	Write DMA Ext		0x2115C7B	0x4		2048	Normal Output	10.885 680 ms	0.179422	-0.531570	1

Figure 3.67: Statistical Reports: Read/Write Command

SAS Address Command Report

To display the SAS Address Command Report, click the **SAS Address** tab (see Figure 3.68 on page 168).The SAS Command Address Report displays the report data in columns with the following information:

- **Source SAS Address**: All, Custom, Number
- **Destination SAS Address**: All, Custom, Number
- **Protocol Type**: All, Custom, SSP, STP, SMP
- **Frame Type**: All, Custom, Data, Response, Command, XFER RDY, Register Device to Host, Register Host to Device, DMA Activate, Task, Request, PIO Setup
- **Count**: All, Custom, Number


File
Setup
Session
Analysis
Navigation
View
Window
Help
Trainer
Jammer
Record
Ch
1
of 909 SAS Address
Move
X-Cursor
General
Primitive
SSP Transport
SMP Transport
FIS
ATA Command
SCSI Command
SMP Command
Task Command
Read/Write Command
SAS Address

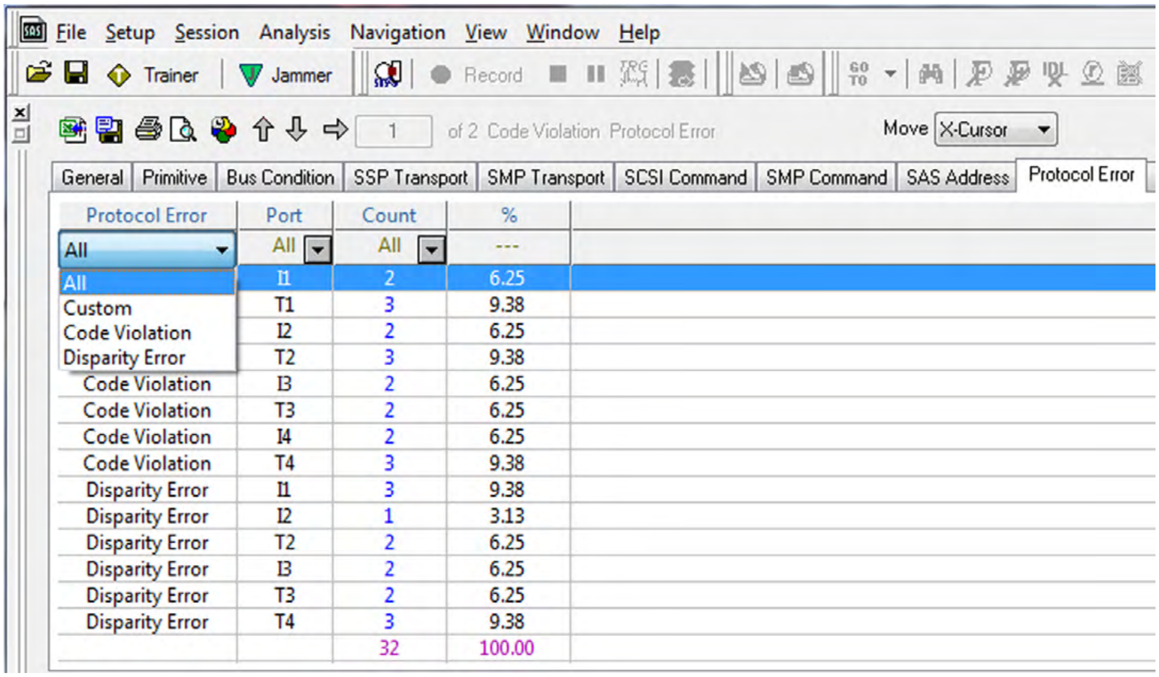
Source SAS Address	Destination SAS Address	Protocol Type	Frame Type	Count
All	All	All	All	All
5000C500001047B5	500062B000001074	SSP	Data	909
5000C500001047B5	500062B000001074	SSP	Response	690
500062B000001074	5000C500001047B5	SSP	Command	690
5000E85000000001	5000C50000103D91	SSP	Command	5
5000C500001047B5	500062B000001074	SSP	XFER RDY	229
500062B000001074	5000C500001047B5	SSP	Data	458
5000C50000103D91	5000E85000000001	SSP	Data	3
5000C50000103D91	5000E85000000001	SSP	Response	6
50060560000003C4	500062B000001074	STP	Data	205
50060560000003C4	500062B000001074	STP	Register Device to Host	299
500062B000001074	50060560000003C4	STP	Register Host to Device	300
50060560000003C4	500062B000001074	STP	DMA Activate	95
500062B000001074	50060560000003C4	STP	Data	95
5000E85000000001	5000C50000103D91	SSP	Task	1
500062B000001074	50060560000003C5	SMP	Request	25
50060560000003C5	500062B000001074	SMP	Response	25
50060560000003C4	500062B000001074	STP	PIO Setup	1
500062B000001074	5000C50000103D91	SSP	Command	11
5000C50000103D91	500062B000001074	SSP	Data	9
5000C50000103D91	500062B000001074	SSP	Response	11
				4067

Figure 3.68: Statistical Reports: SAS Address Command

Protocol Error Report

To display the Protocol Error Report, click the **Protocol Error** tab (see Figure 3.69 on page 169). The Protocol Error Report displays the report data in columns with the following information:

- ❑ **Protocol Error**: All, Custom, Code Violation, CRC Error, Disparity Error, Align-Notify Error
- ❑ **Port**: All, H1, I1, H2, I2, H3, I3, H4, I4, or Custom
- ❑ **Count**: All, Custom, or a number of occurrences
- ❑ **%**: Percentage of total count


File
Setup
Session
Analysis
Navigation
View
Window
Help
Trainer
Jammer
Record
1
of 2 Code Violation Protocol Error
Move
X-Cursor
General
Primitive
Bus Condition
SSP Transport
SMP Transport
SCSI Command
SMP Command
SAS Address
Protocol Error
All
Custom
Code Violation
Disparity Error

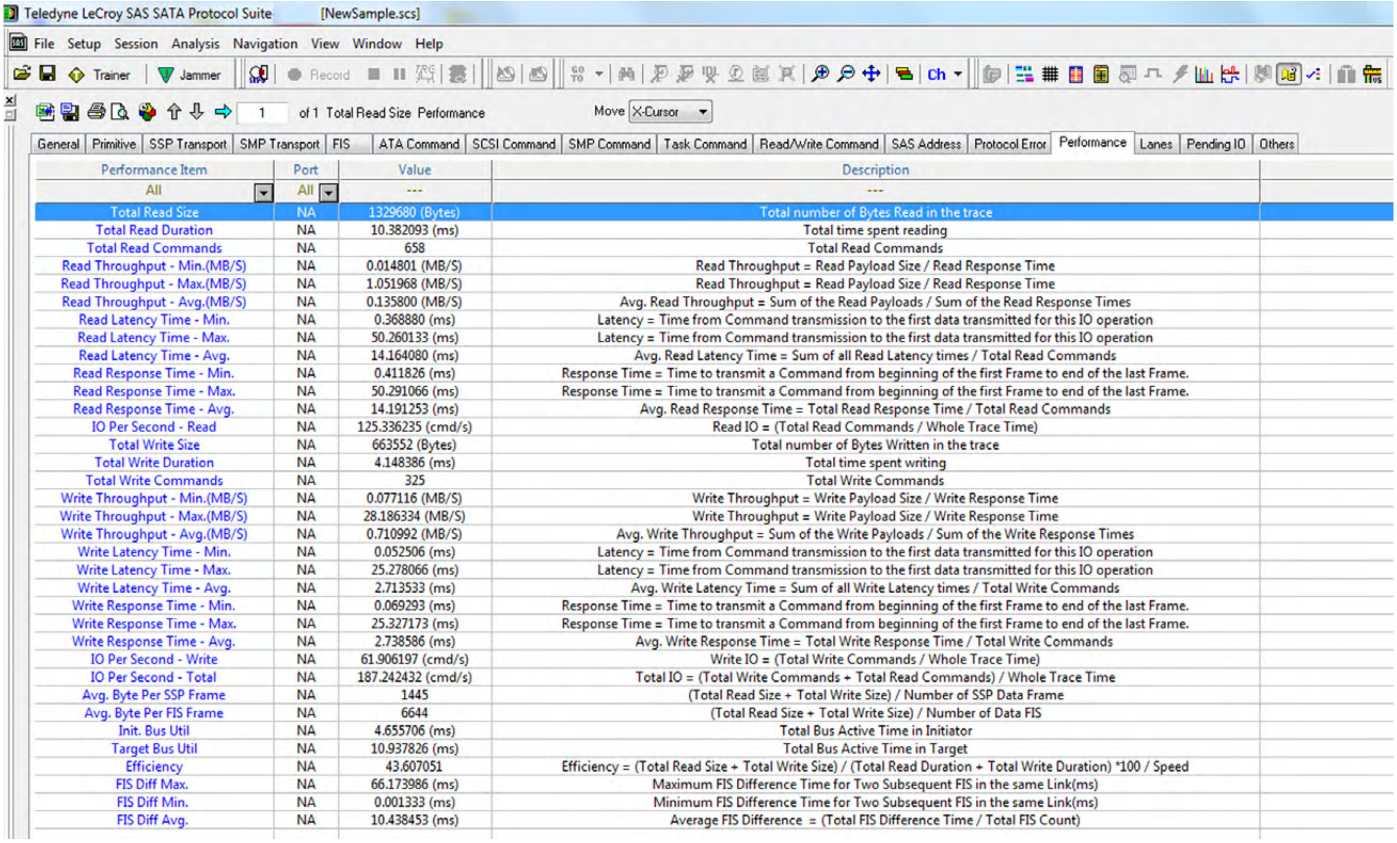
Protocol Error	Port	Count	%
All	All	All	---
	I1	2	6.25
	T1	3	9.38
	I2	2	6.25
	T2	3	9.38
Code Violation	I3	2	6.25
Code Violation	T3	2	6.25
Code Violation	I4	2	6.25
Code Violation	T4	3	9.38
Disparity Error	I1	3	9.38
Disparity Error	I2	1	3.13
Disparity Error	T2	2	6.25
Disparity Error	I3	2	6.25
Disparity Error	T3	2	6.25
Disparity Error	T4	3	9.38
		32	100.00

Figure 3.69: Statistical Reports: Protocol Error Report.

Performance Report

To display the Performance Report, click the **Performance** tab (see Figure 3.70 on page 170). The Performance Report displays the report data in columns with the following information:

- **Performance Items**: All, Custom, Total Read Size, Total Read Duration, Total Read Commands, Min., Max., Ave. Read Throughput, Min., Max., Ave. Read Latency Time, Min., Max., Ave. Read Response Time, Read IO Per Second, Total Write Size, Duration, Commands, Min., Max., Ave. Write Throughput, Min., Max., Ave. Write Latency Time, Min., Max., Ave. Write Response Time, Write IO Per Second, Total IO Per Second, Ave. Byte Per SSP Frame, Ave. Byte Per FISFrame, Init. Bus Util, Target Bus Util, Efficiency, Max., Min., Ave., FIS Diff
- **Port**: All, H1, I1, H2, I2, H3, I3, H4, I4, Custom, or NA
- **Value**: Number
- **Description**: Definition of Performance Items


Teledyne LeCroy SAS SATA Protocol Suite [NewSample.scs]
File Setup Session Analysis Navigation View Window Help
Trainer Jammer Record Ch
1 of 1 Total Read Size Performance
Move X-Cursor
General Primitive SSP Transport SMP Transport FIS ATA Command SCSI Command SMP Command Task Command Read/Write Command SAS Address Protocol Error Performance Lanes Pending IO Others

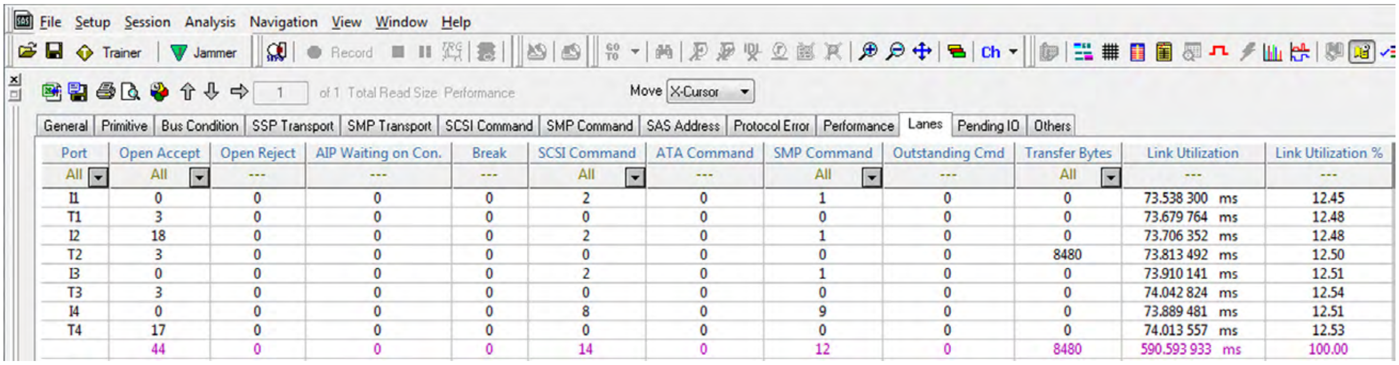
Performance Item	Port	Value	Description
All	All	---	---
Total Read Size	NA	1329680 (Bytes)	Total number of Bytes Read in the trace
Total Read Duration	NA	10.382093 (ms)	Total time spent reading
Total Read Commands	NA	658	Total Read Commands
Read Throughput - Min.(MB/S)	NA	0.014801 (MB/S)	Read Throughput = Read Payload Size / Read Response Time
Read Throughput - Max.(MB/S)	NA	1.051968 (MB/S)	Read Throughput = Read Payload Size / Read Response Time
Read Throughput - Avg.(MB/S)	NA	0.135800 (MB/S)	Avg. Read Throughput = Sum of the Read Payloads / Sum of the Read Response Times
Read Latency Time - Min.	NA	0.368880 (ms)	Latency = Time from Command transmission to the first data transmitted for this IO operation
Read Latency Time - Max.	NA	50.260133 (ms)	Latency = Time from Command transmission to the first data transmitted for this IO operation
Read Latency Time - Avg.	NA	14.164080 (ms)	Avg. Read Latency Time = Sum of all Read Latency times / Total Read Commands
Read Response Time - Min.	NA	0.411826 (ms)	Response Time = Time to transmit a Command from beginning of the first Frame to end of the last Frame.
Read Response Time - Max.	NA	50.291066 (ms)	Response Time = Time to transmit a Command from beginning of the first Frame to end of the last Frame.
Read Response Time - Avg.	NA	14.191253 (ms)	Avg. Read Response Time = Total Read Response Time / Total Read Commands
IO Per Second - Read	NA	125.336235 (cmd/s)	Read IO = (Total Read Commands / Whole Trace Time)
Total Write Size	NA	663552 (Bytes)	Total number of Bytes Written in the trace
Total Write Duration	NA	4.148386 (ms)	Total time spent writing
Total Write Commands	NA	325	Total Write Commands
Write Throughput - Min.(MB/S)	NA	0.077116 (MB/S)	Write Throughput = Write Payload Size / Write Response Time
Write Throughput - Max.(MB/S)	NA	28.186334 (MB/S)	Write Throughput = Write Payload Size / Write Response Time
Write Throughput - Avg.(MB/S)	NA	0.710992 (MB/S)	Avg. Write Throughput = Sum of the Write Payloads / Sum of the Write Response Times
Write Latency Time - Min.	NA	0.052506 (ms)	Latency = Time from Command transmission to the first data transmitted for this IO operation
Write Latency Time - Max.	NA	25.278066 (ms)	Latency = Time from Command transmission to the first data transmitted for this IO operation
Write Latency Time - Avg.	NA	2.713533 (ms)	Avg. Write Latency Time = Sum of all Write Latency times / Total Write Commands
Write Response Time - Min.	NA	0.069293 (ms)	Response Time = Time to transmit a Command from beginning of the first Frame to end of the last Frame.
Write Response Time - Max.	NA	25.327173 (ms)	Response Time = Time to transmit a Command from beginning of the first Frame to end of the last Frame.
Write Response Time - Avg.	NA	2.738586 (ms)	Avg. Write Response Time = Total Write Response Time / Total Write Commands
IO Per Second - Write	NA	61.906197 (cmd/s)	Write IO = (Total Write Commands / Whole Trace Time)
IO Per Second - Total	NA	187.242432 (cmd/s)	Total IO = (Total Write Commands + Total Read Commands) / Whole Trace Time
Avg. Byte Per SSP Frame	NA	1445	(Total Read Size + Total Write Size) / Number of SSP Data Frame
Avg. Byte Per FIS Frame	NA	6644	(Total Read Size + Total Write Size) / Number of Data FIS
Init. Bus Util	NA	4.655706 (ms)	Total Bus Active Time in Initiator
Target Bus Util	NA	10.937826 (ms)	Total Bus Active Time in Target
Efficiency	NA	43.607051	Efficiency = (Total Read Size + Total Write Size) / (Total Read Duration + Total Write Duration) *100 / Speed
FIS Diff Max.	NA	66.173986 (ms)	Maximum FIS Difference Time for Two Subsequent FIS in the same Link(ms)
FIS Diff Min.	NA	0.001333 (ms)	Minimum FIS Difference Time for Two Subsequent FIS in the same Link(ms)
FIS Diff Avg.	NA	10.438453 (ms)	Average FIS Difference = (Total FIS Difference Time / Total FIS Count)

Figure 3.70: Statistical Reports: Performance Items

Lanes Report

To display the Lanes Report, click the **Lanes** tab (see Figure 3.71 on page 171). The Lanes Report displays the report data in columns with the following information:

- **Port**: All, H1, I1, H2, I2, H3, I3, H4, I4,or Custom
- **Open Accept**: All, Custom or Number
- **Open Reject**: Number
- **AIP Waiting on Con.**: Number
- **Break**: Number
- **SCSI Command**: All, Custom or Number
- **ATA Command**: Number
- **SMP Command**: All, Custom or Number
- **Outstanding Command**: Number
- **Transfer Bytes**: All, Custom or Number
- **Link Utilization**: Number
- **Link Utilization %**: Percentage of total count


File Setup Session Analysis Navigation View Window Help
Trainer
Jammer
Record
Ch
1
of 1 Total Read Size Performance
Move X-Cursor
General Primitive Bus Condition SSP Transport SMP Transport SCSI Command SMP Command SAS Address Protocol Error Performance Lanes Pending IO Others

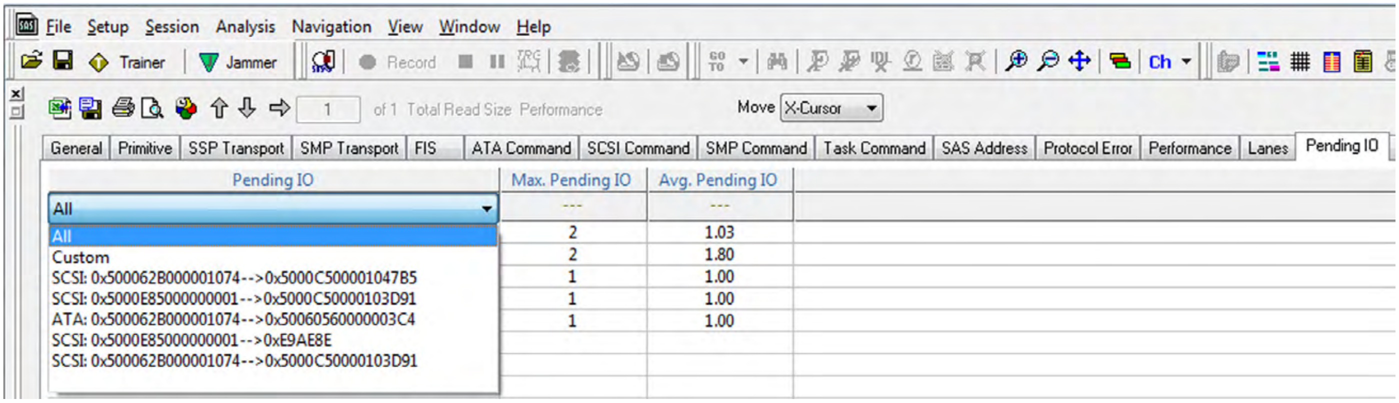
Port	Open Accept	Open Reject	AIP Waiting on Con.	Break	SCSI Command	ATA Command	SMP Command	Outstanding Cmd	Transfer Bytes	Link Utilization	Link Utilization %
All	All	---	---	---	All	---	All	---	All	---	---
I1	0	0	0	0	2	0	1	0	0	73.538 300 ms	12.45
T1	3	0	0	0	0	0	0	0	0	73.679 764 ms	12.48
I2	18	0	0	0	2	0	1	0	0	73.706 352 ms	12.48
T2	3	0	0	0	0	0	0	0	8480	73.813 492 ms	12.50
I3	0	0	0	0	2	0	1	0	0	73.910 141 ms	12.51
T3	3	0	0	0	0	0	0	0	0	74.042 824 ms	12.54
I4	0	0	0	0	8	0	9	0	0	73.889 481 ms	12.51
T4	17	0	0	0	0	0	0	0	0	74.013 557 ms	12.53
	44	0	0	0	14	0	12	0	8480	590.593 933 ms	100.00

Figure 3.71: Statistical Reports: Lanes Report

Pending I/O Report

To display the Pending IO Report, click the **Pending IO** tab (see Figure 3.72).The Pending IO Report displays the report data in columns with the following information:

- **Pending IO:** All, Custom, SCSI or ATA
- **Max. Pending IO:** All, Custom, or Number
- **Ave. Pending IO:** All, Custom, or Number


File Setup Session Analysis Navigation View Window Help
Trainer
Jammer
Record
Ch
1
of 1 Total Read Size Performance
Move X-Cursor
General Primitive SSP Transport SMP Transport FIS ATA Command SCSI Command SMP Command Task Command SAS Address Protocol Error Performance Lanes Pending IO

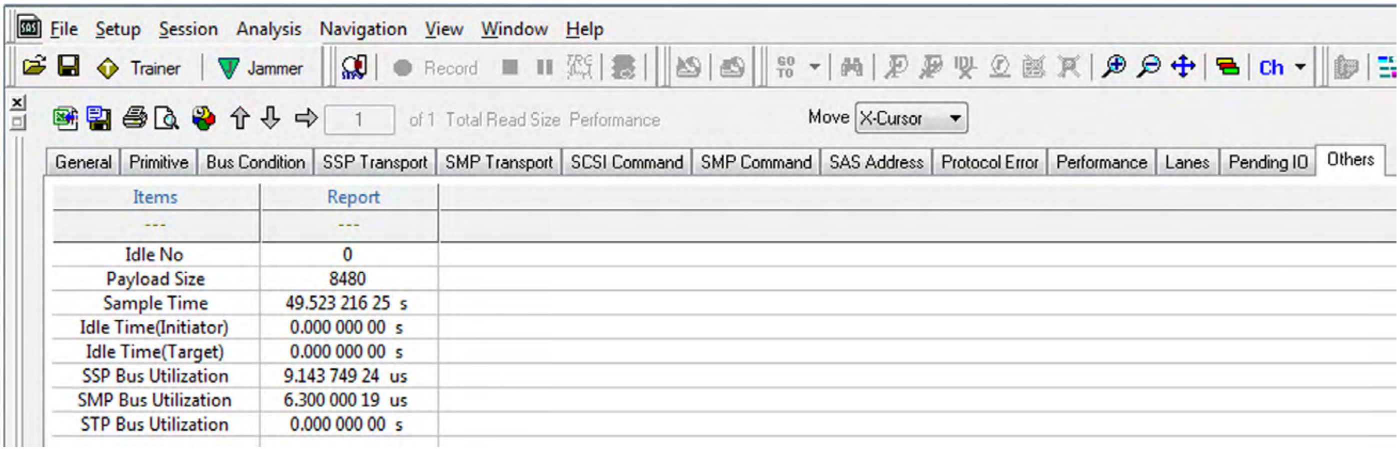
Pending IO	Max. Pending IO	Avg. Pending IO
All	---	---
All	2	1.03
Custom	2	1.80
SCSI: 0x500062B000001074-->0x5000C500001047B5	1	1.00
SCSI: 0x5000E85000000001-->0x5000C50000103D91	1	1.00
ATA: 0x500062B000001074-->0x50060560000003C4	1	1.00
SCSI: 0x5000E85000000001-->0xE9AE8E		
SCSI: 0x500062B000001074-->0x5000C50000103D91		

Figure 3.72: Statistical Reports: Pending IO

Others Report

To display the Others Report (see Figure 3.73 on page 172), click the **Others** tab. The Others Report displays information in the following columns:

- Items
    - Idle No: Number of idle packets
    - Payload Size: Total number of payloads in trace files (SCSI + ATA commands)
    - Sample Time: Sample time
    - Idle (Initiator): Host idle time
    - Idle (Target): Device idle time (total)
    - SSP Bus Utilization: SSP bus utilization time (SSP frames)
    - SMP Bus Utilization: SSP bus utilization time (SMP frames)
    - STP Bus Utilization: SSP bus utilization time (STP frames)
- Report
    - Count or Time

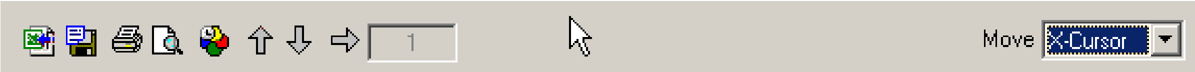

File
Setup
Session
Analysis
Navigation
View
Window
Help
Trainer
Jammer
Record
Ch
1
of 1 Total Read Size Performance
Move
X-Cursor
General
Primitive
Bus Condition
SSP Transport
SMP Transport
SCSI Command
SMP Command
SAS Address
Protocol Error
Performance
Lanes
Pending IO
Others

Items	Report
---	---
Idle No	0
Payload Size	8480
Sample Time	49.523 216 25 s
Idle Time(Initiator)	0.000 000 00 s
Idle Time(Target)	0.000 000 00 s
SSP Bus Utilization	9.143 749 24 us
SMP Bus Utilization	6.300 000 19 us
STP Bus Utilization	0.000 000 00 s

Figure 3.73: Statistical Reports: Others Report.

3.3.12 Statistical Report Toolbar

- The Statistical Report toolbar provides the following functions accessible by buttons on the toolbar:
- Export to Excel
- Save as Text
- Print Report
- Print Preview
- Report Display Settings
- Move to **X-Cursor, Y-Cursor**, or **None**


1
Move
X-Cursor

Export as Microsoft® Excel file

The **Export to Excel** button opens the Export to Excel dialog. Choose a folder in which to save the Excel file, choose an appropriate file name, and click **Save.**

Save as Text file

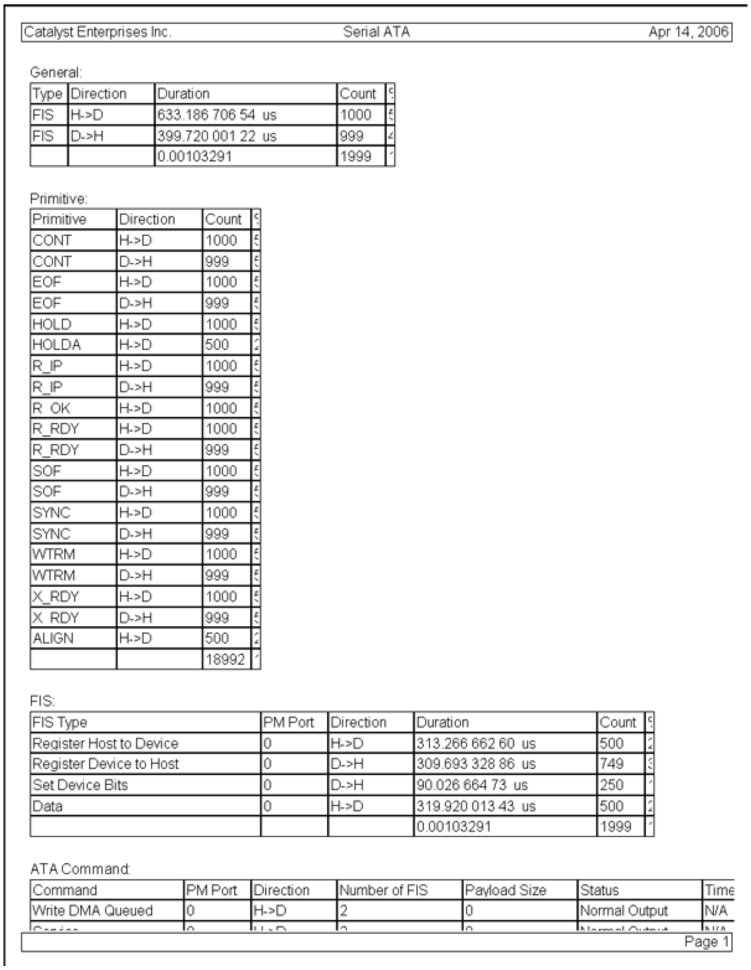
The **Save as Text** button opens the Export to Text dialog. Choose a folder in which to save the Text file, choose an appropriate file name, and click **Save.**

Print Statistical Report

The **Print** button opens the select printer dialog. Choose an available printer and click **OK.**

Print Preview

The **Print Preview** button displays a preview of the report to print.



Catalyst Enterprises Inc. Serial ATA Apr 14, 2006

General:

Type	Direction	Duration	Count
FIS	H->D	633.186 706 54 us	1000
FIS	D->H	399.720 001 22 us	999
		0.00103291	1999

Primitive:

Primitive	Direction	Count
CONT	H->D	1000
CONT	D->H	999
EOF	H->D	1000
EOF	D->H	999
HOLD	H->D	1000
HOLDA	H->D	500
R_IP	H->D	1000
R_IP	D->H	999
R OK	H->D	1000
R_RDY	H->D	1000
R_RDY	D->H	999
SOF	H->D	1000
SOF	D->H	999
SYNC	H->D	1000
SYNC	D->H	999
WTRM	H->D	1000
WTRM	D->H	999
X_RDY	H->D	1000
X RDY	D->H	999
ALIGN	H->D	500
		18992

FIS:

FIS Type	PM Port	Direction	Duration	Count
Register Host to Device	0	H->D	313.266 662 60 us	500
Register Device to Host	0	D->H	309.693 328 86 us	749
Set Device Bits	0	D->H	90.026 664 73 us	250
Data	0	H->D	319.920 013 43 us	500
			0.00103291	1999

ATA Command:

Command	PM Port	Direction	Number of FIS	Payload Size	Status	Time
Write DMA Queued	0	H->D	2	0	Normal Output	N/A

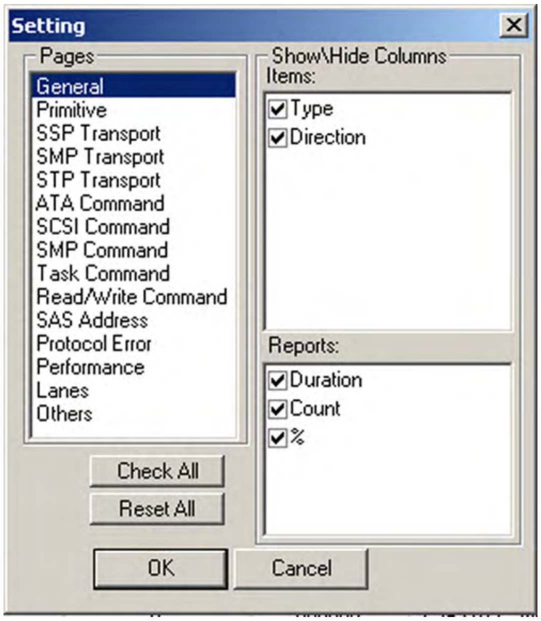
Page 1

Figure 3.74: Sample Print Preview of Report

Report Display Settings

The **Setting** button opens the Setting dialog.

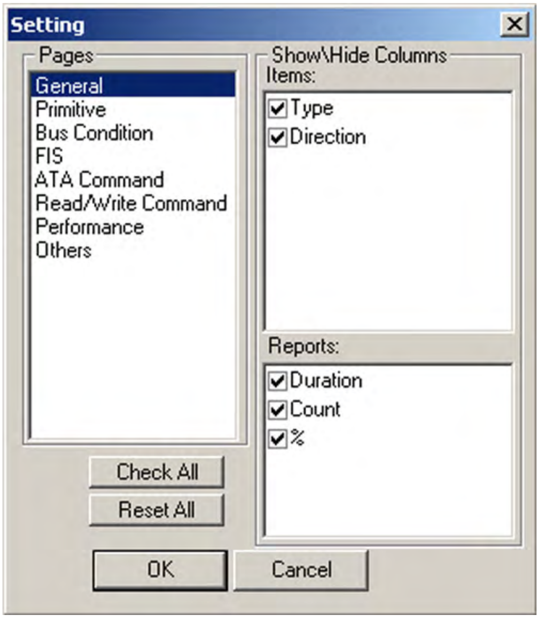
You can set up the report columns for display to suit a particular analysis need, eliminating the need to show/hide columns individually. Use the **Setting** dialog to configure the display for each page (see Figure 3.75 and Figure 3.76).


Setting
Pages
General
Primitive
SSP Transport
SMP Transport
STP Transport
ATA Command
SCSI Command
SMP Command
Task Command
Read/Write Command
SAS Address
Protocol Error
Performance
Lanes
Others
Check All
Reset All
OK
Cancel
Show\Hide Columns
Items:
Reports:

☑ Type
☑ Direction

☑ Duration
☑ Count
☑ %

Figure 3.75: SAS: Statistical Report Column Setting


Setting
Pages
General
Primitive
Bus Condition
FIS
ATA Command
Read/Write Command
Performance
Others
Check All
Reset All
OK
Cancel
Show\Hide Columns
Items:
Reports:

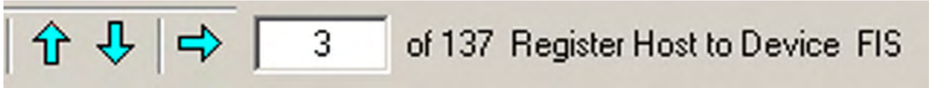
☑ Type
☑ Direction

☑ Duration
☑ Count
☑ %

Figure 3.76: SATA: Statistical Report Column Setting

Link With Sample View

When you select a type on any page of the Statistical Report, a set of navigation buttons allows you to examine each instance of that type in the Sample Viewer.


3
of 137 Register Host to Device FIS

⇧	The **Jump to Previous** button goes to the previous instance of the selected type in the Sample Viewer.
⇩	The **Jump to Next** button goes to the next instance of the selected type in the Sample Viewer.
⇨	The **Jump to Specific** button goes to the instance specified as N of M items on the Statistical Report toolbar.
Move X-Cursor	The **Move** drop-down list moves to the X-Cursor, Y-Cursor, or None.

3.3.13 Formatting the Statistical Report View

Initially the Statistical Report View contains all of the information in columns, but you can customize the display by:

- ❑ Filtering columns by item
- ❑ Sorting items by column
- ❑ Hiding any column on the display

Filtering Column Content

To filter column content, click the down arrow in the heading for that column and choose the items to display. The default is All. By checking a specific item, you exclude everything but that item for display.

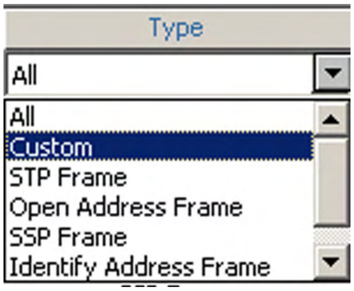
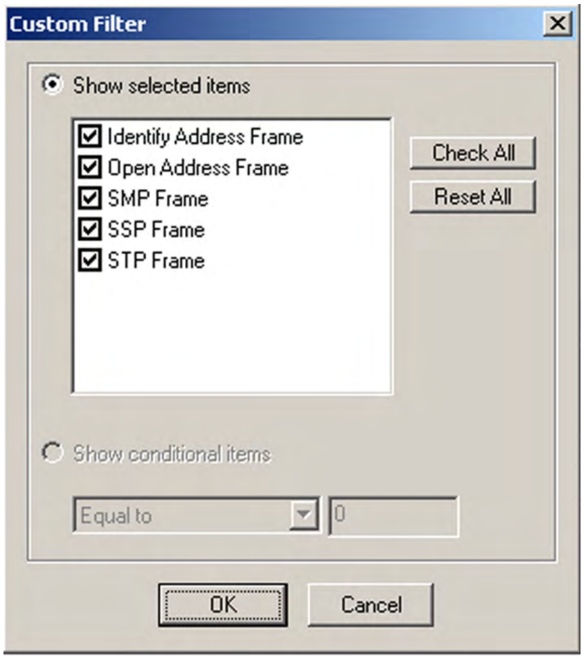

Type
All
All
Custom
STP Frame
Open Address Frame
SSP Frame
Identify Address Frame

Figure 3.77: SAS: Type

Choosing **Custom** allows you to specify more than one item for display (see Figure 3.78 on page 176).



Custom Filter

● Show selected items

☑ Identify Address Frame
☑ Open Address Frame
☑ SMP Frame
☑ SSP Frame
☑ STP Frame

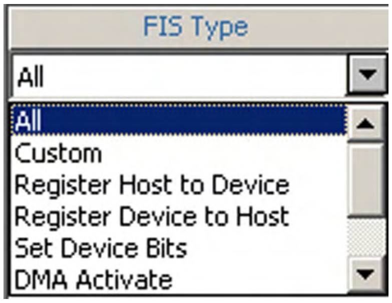
○ Show conditional items

Equal to 0

Check All
Reset All
OK
Cancel

Figure 3.78: SAS: Custom Filter

.

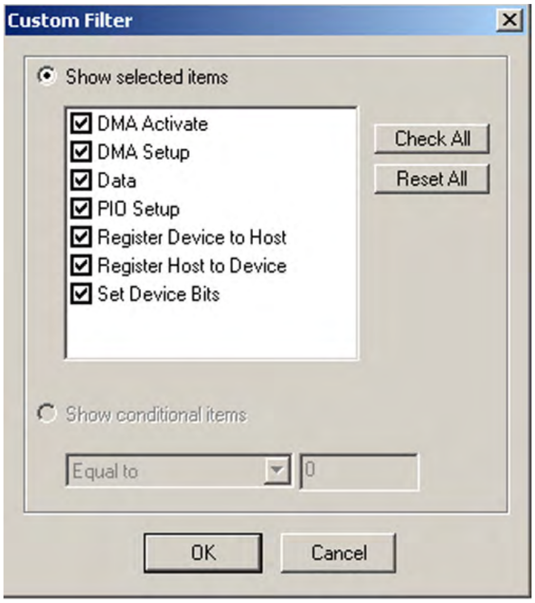


FIS Type: All

All
Custom
Register Host to Device
Register Device to Host
Set Device Bits
DMA Activate

Figure 3.79: SATA: FIS Type

Choosing **Custom** allows you to specify more than one item for display (see Figure 3.80 on page 177).



● Show selected items

- ☑ DMA Activate
- ☑ DMA Setup
- ☑ Data
- ☑ PIO Setup
- ☑ Register Device to Host
- ☑ Register Host to Device
- ☑ Set Device Bits

○ Show conditional items

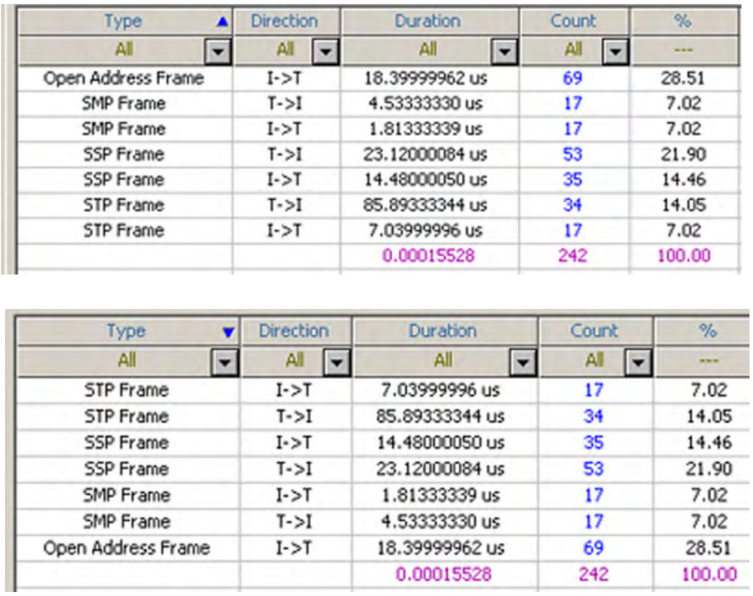
Equal to 0

Figure 3.80: SATA: Custom Filter

Check the items to display and click **OK**.

Sorting Column Content

To sort column content, click the **heading** for that column. Repeated clicking of the column heading sorts the column in ascending or descending order.



Type ▲	Direction	Duration	Count	%
All	All	All	All	---
Open Address Frame	I->T	18.39999962 us	69	28.51
SMP Frame	T->I	4.53333330 us	17	7.02
SMP Frame	I->T	1.81333339 us	17	7.02
SSP Frame	T->I	23.12000084 us	53	21.90
SSP Frame	I->T	14.48000050 us	35	14.46
STP Frame	T->I	85.89333344 us	34	14.05
STP Frame	I->T	7.03999996 us	17	7.02
		0.00015528	242	100.00

Type ▼	Direction	Duration	Count	%
All	All	All	All	---
STP Frame	I->T	7.03999996 us	17	7.02
STP Frame	T->I	85.89333344 us	34	14.05
SSP Frame	I->T	14.48000050 us	35	14.46
SSP Frame	T->I	23.12000084 us	53	21.90
SMP Frame	I->T	1.81333339 us	17	7.02
SMP Frame	T->I	4.53333330 us	17	7.02
Open Address Frame	I->T	18.39999962 us	69	28.51
		0.00015528	242	100.00

Figure 3.81: Toggling Type Sort Order

Hiding Columns

To hide a column, right-click in the column and choose **Hide**. To unhide a column, right-click any column and choose **Unhide**.

3.3.14 Histogram View

The Histogram View displays a histogram of frame-type transfers.

To display the Histogram View of the current capture, click **Analysis > Histogram View** or click the button on the toolbar.

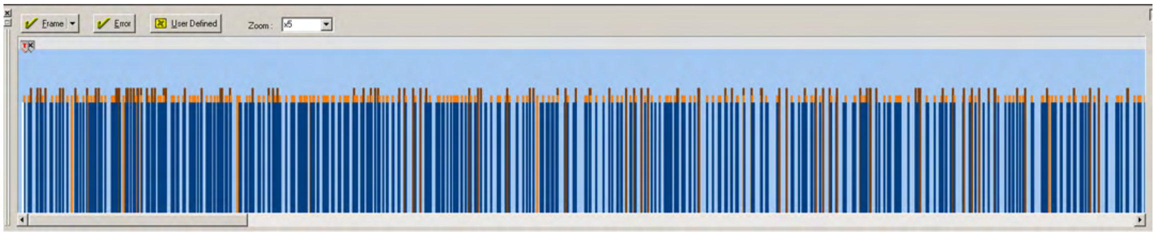

Frame
Error
User Defined
Zoom :
x5

Figure 3.82: Histogram View

Hide Frames

You can customize the histogram by including only frame types that you want.

To choose frame types to include in the display, click the down arrow on the **Frame** button on the Histogram toolbar and check frame types:

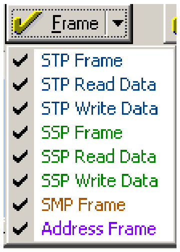

Frame
STP Frame
STP Read Data
STP Write Data
SSP Frame
SSP Read Data
SSP Write Data
SMP Frame
Address Frame

Figure 3.83: SAS: Histogram Frames

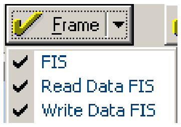

Frame
FIS
Read Data FIS
Write Data FIS

Figure 3.84: SAS: Histogram Frames

Hide Error Frames

Frames with errors are displayed in red. To hide error frames from the histogram, click the ✓ Error button.

Note: To display the error code of a protocol error, click the error icon (with the red 'x').

User Defined

You can define additional items for inclusion in the Histogram by clicking the User Defined button to open the User Defined dialog.

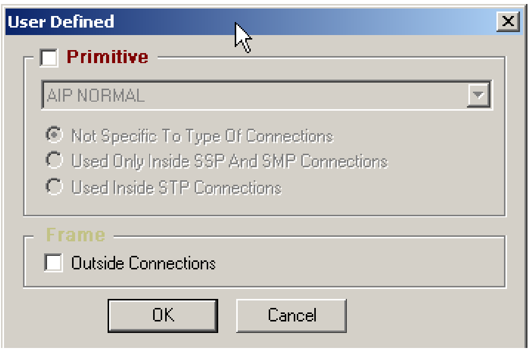

User Defined
☐ Primitive
AIP NORMAL
● Not Specific To Type Of Connections
○ Used Only Inside SSP And SMP Connections
○ Used Inside STP Connections
Frame
☐ Outside Connections
OK
Cancel

Figure 3.85: SAS: Histogram User Defined Dialog

You can include Primitive and/or Outside Connections frames.

Primitives

To include Primitives, check the **Primitive** check box, click the down arrow on the Primitive list box, and choose a Primitive.

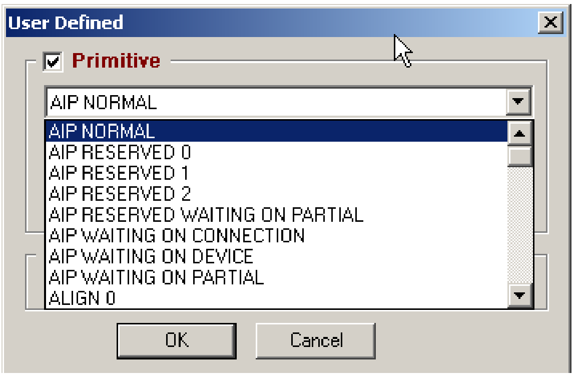

User Defined
☑ Primitive
AIP NORMAL
AIP NORMAL
AIP RESERVED 0
AIP RESERVED 1
AIP RESERVED 2
AIP RESERVED WAITING ON PARTIAL
AIP WAITING ON CONNECTION
AIP WAITING ON DEVICE
AIP WAITING ON PARTIAL
ALIGN 0
OK
Cancel

Figure 3.86: SAS: Choosing a Primitive

.

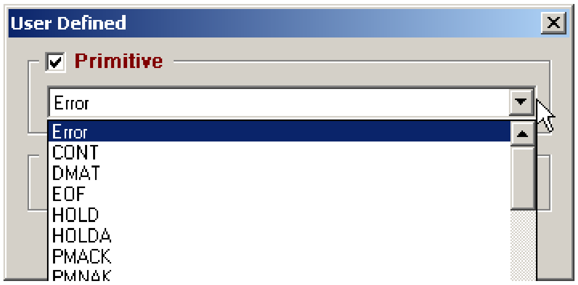

User Defined
☑ Primitive
Error
Error
CONT
DMAT
EOF
HOLD
HOLDA
PMACK
PMNAK

Figure 3.87: SATA: Choosing a Primitive

Check a Connection Type option radio button, if available, and click **OK**.

Zoom

You can Zoom from x1 to x256.

3.3.15 Bus Utilization View

The Bus Utilization View displays information on pending IO, IO Throughput, Latency Time and Response Time. To display the Bus Utilization View of the current capture, Select Analysis from the Main Toolbar, see Figure 3.88.

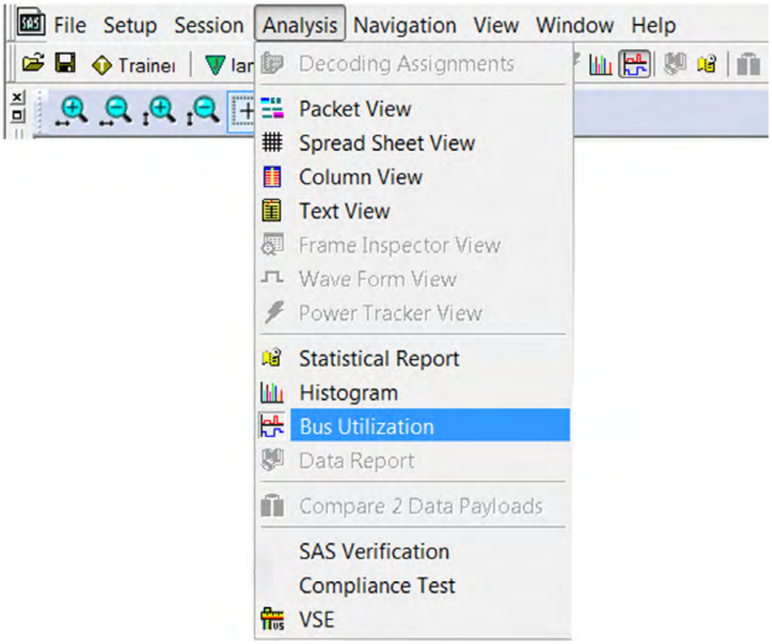

File
Setup
Session
Analysis
Navigation
View
Window
Help
Trainer
Decoding Assignments
Packet View
Spread Sheet View
Column View
Text View
Frame Inspector View
Wave Form View
Power Tracker View
Statistical Report
Histogram
Bus Utilization
Data Report
Compare 2 Data Payloads
SAS Verification
Compliance Test
VSE

Figure 3.88: Analysis: Bus Utilization Dialog

then

select **Bus Utilization View** or click the button on the main tool bar.

This will bring up the Bus Utilization Toolbar (see Figure 3.89), which has the following functions:

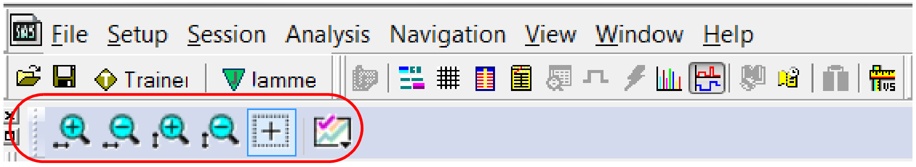

File
Setup
Session
Analysis
Navigation
View
Window
Help
Trainer
Jammer

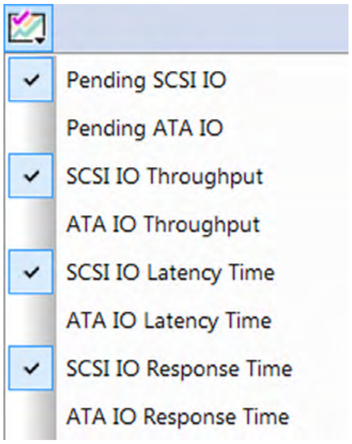
Figure 3.89: Bus Utilization Toolbar Functions

- ❑ Horizontal zoom in
- ❑ Horizontal zoom out
- ❑ Vertical zoom in
- ❑ Vertical zoom out
- ❑ Click and drag zoom mode
- ❑ Graph areas

Select functions to view from the Available Bus Utilization Views from the Graph areas icon:

- Pending SCSI IO (for SAS): Shows number of pending commands
- Pending ATA IO (for SATA): Shows number of pending commands
- SCSI IO Throughput (for SAS): The payload divided by response time expressed in MB per second.
- ATA IO Throughput (for SATA): The payload divided by response time expressed in MB per second.
- SCSI IO Latency Time (for SAS): The time measured from the transmission of the command to the first data transmitted for this IO operation.
- ATA IO Latency Time (for SATA): The time measured from the transmission of the command to the first data transmitted for this IO operation.
- SCSI IO Response Time (for SAS): The time taken to transmit this command on the link(s) from the beginning of the first frame in the command to the end of the last frame in the command.
- ATA IO Response Time (for SATA): The time taken to transmit this command on the link(s) from the beginning of the first frame in the command to the end of the last frame in the command.

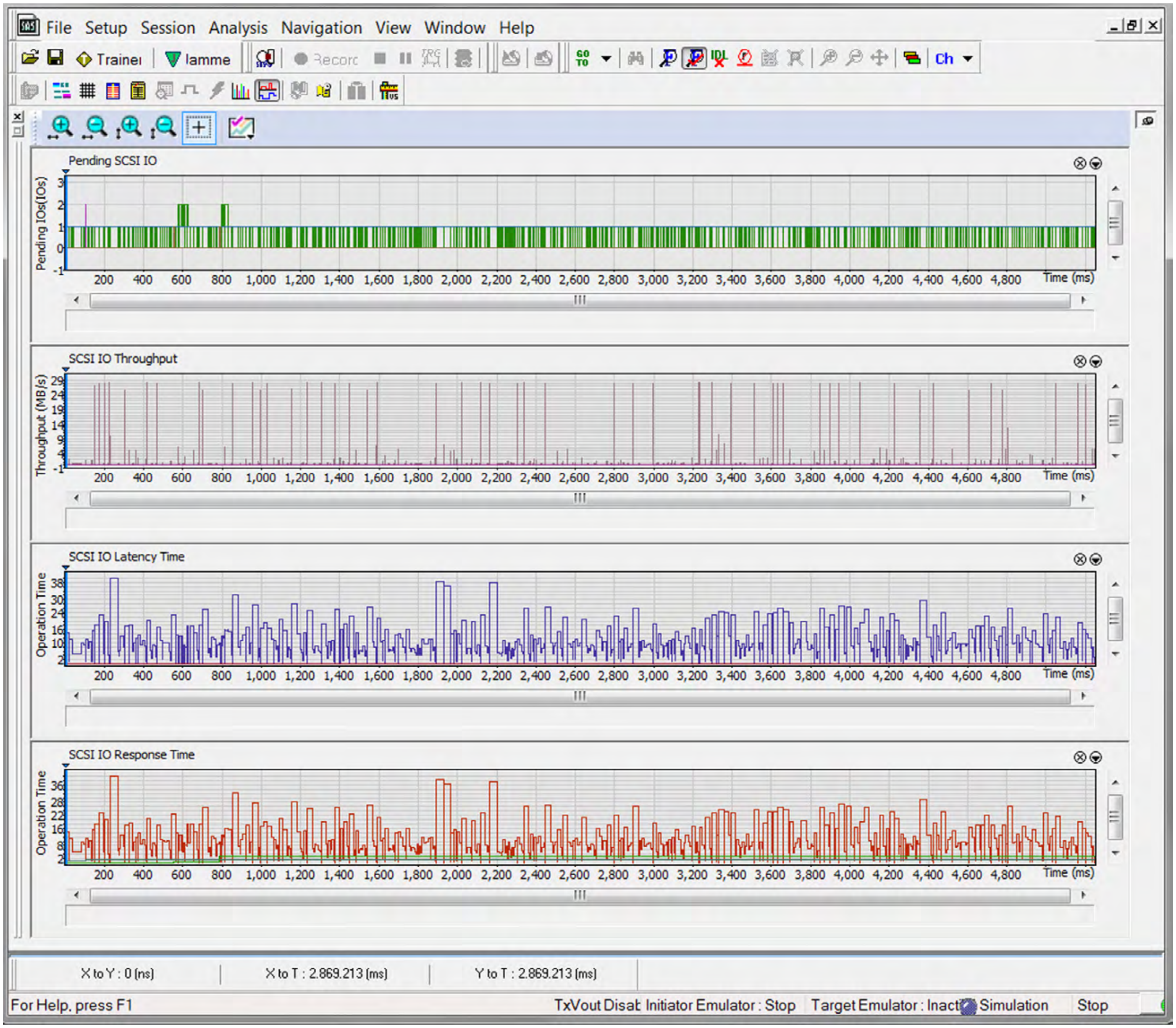
See figure below (Figure 3.90).



✓ Pending SCSI IO
Pending ATA IO
✓ SCSI IO Throughput
ATA IO Throughput
✓ SCSI IO Latency Time
ATA IO Latency Time
✓ SCSI IO Response Time
ATA IO Response Time

Figure 3.90: Graph Selected Functions: SCSI Functions Selected

This will bring up graphs for the Selected functions (see Figure 3.91 on page 182).

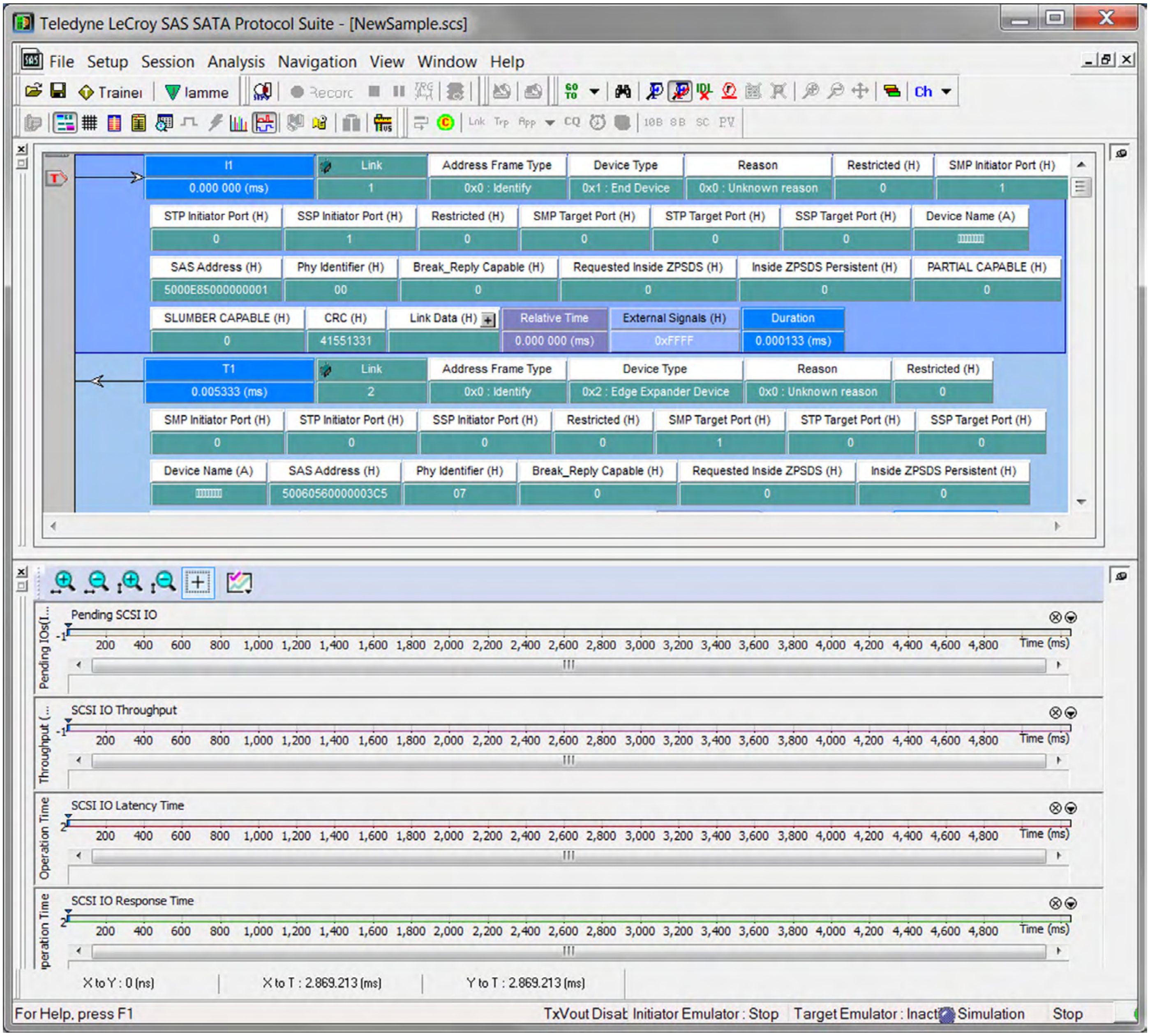

File
Setup
Session
Analysis
Navigation
View
Window
Help
Trainer
lamme
Record
Ch
Pending SCSI IO
Pending IOs(IOs)
3
2
1
0
-1
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
2,400
2,600
2,800
3,000
3,200
3,400
3,600
3,800
4,000
4,200
4,400
4,600
4,800
Time (ms)
SCSI IO Throughput
Throughput (MB/s)
29
24
19
14
9
4
-1
SCSI IO Latency Time
Operation Time
38
30
24
16
10
2
SCSI IO Response Time
Operation Time
36
28
22
16
8
2

X to Y : 0 (ns)
X to T : 2.869.213 (ms)
Y to T : 2.869.213 (ms)

For Help, press F1
TxVout Disab Initiator Emulator : Stop Target Emulator : Inact Simulation Stop

Figure 3.91: Waveform View for Full Trace

Select Packet View to see both the Packet and the Waveforms. See Figure 3.92 on page 183.


Teledyne LeCroy SAS SATA Protocol Suite - [NewSample.scs]
File Setup Session Analysis Navigation View Window Help
Trainei
lamme
Recorc
Ch
Lnk Trp App CQ 10B 8B SC PV

I1	Link	Address Frame Type	Device Type	Reason	Restricted (H)	SMP Initiator Port (H)
0.000 000 (ms)	1	0x0 : Identify	0x1 : End Device	0x0 : Unknown reason	0	1

STP Initiator Port (H)	SSP Initiator Port (H)	Restricted (H)	SMP Target Port (H)	STP Target Port (H)	SSP Target Port (H)	Device Name (A)
0	1	0	0	0	0	IIIIIIIII

SAS Address (H)	Phy Identifier (H)	Break_Reply Capable (H)	Requested Inside ZPSDS (H)	Inside ZPSDS Persistent (H)	PARTIAL CAPABLE (H)
5000E85000000001	00	0	0	0	0

SLUMBER CAPABLE (H)	CRC (H)	Link Data (H)	Relative Time	External Signals (H)	Duration
0	41551331		0.000 000 (ms)	0xFFFF	0.000133 (ms)

T1	Link	Address Frame Type	Device Type	Reason	Restricted (H)
0.005333 (ms)	2	0x0 : Identify	0x2 : Edge Expander Device	0x0 : Unknown reason	0

SMP Initiator Port (H)	STP Initiator Port (H)	SSP Initiator Port (H)	Restricted (H)	SMP Target Port (H)	STP Target Port (H)	SSP Target Port (H)
0	0	0	0	1	0	0

Device Name (A)	SAS Address (H)	Phy Identifier (H)	Break_Reply Capable (H)	Requested Inside ZPSDS (H)	Inside ZPSDS Persistent (H)
IIIIIIIII	50060560000003C5	07	0	0	0

Pending SCSI IO
Pending IOs(...
SCSI IO Throughput
Throughput (...
SCSI IO Latency Time
Operation Time
SCSI IO Response Time
Operation Time
200 400 600 800 1,000 1,200 1,400 1,600 1,800 2,000 2,200 2,400 2,600 2,800 3,000 3,200 3,400 3,600 3,800 4,000 4,200 4,400 4,600 4,800
Time (ms)

X to Y : 0 (ns) X to T : 2.869.213 (ms) Y to T : 2.869.213 (ms)

For Help, press F1 TxVout Disat Initiator Emulator : Stop Target Emulator : Inact Simulation Stop

Figure 3.92: Packet and Waveform Views

Right clicking the mouse over the graph heading displays the graph legend:

- **Go to ATA/SCSI Cmd. #**: Jump to command.
- **Synchronize with Trace View**: Synchronize all open views to that location in the trace.
- **Fit to Graph Area**: Zoom to fit.
- **Hide**: Do not display the graph.

See Figure 3.93 on page 184.

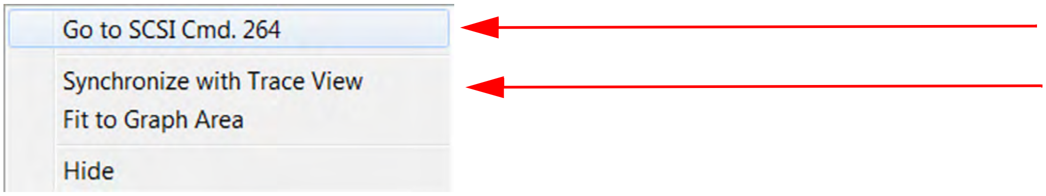
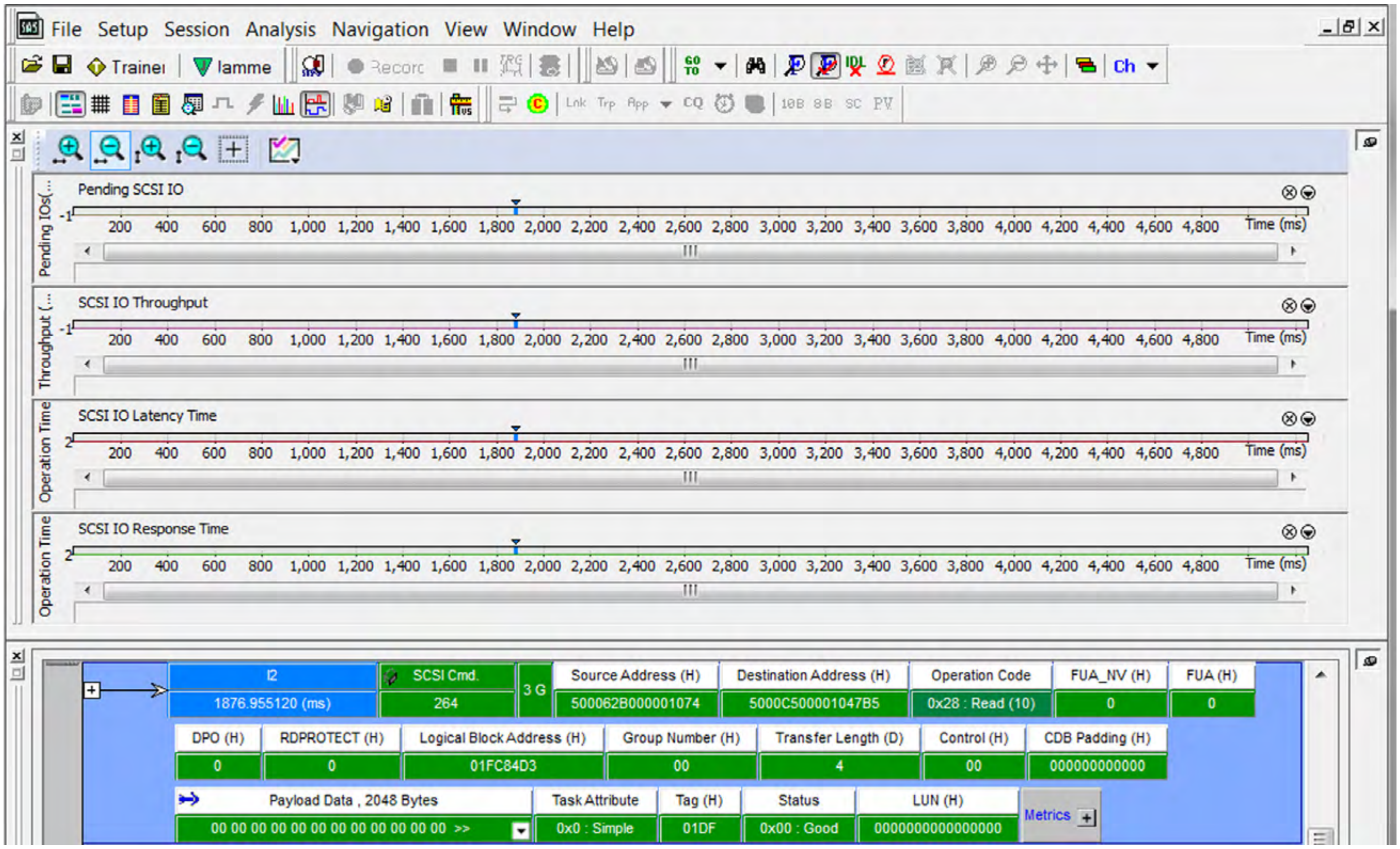

Go to SCSI Cmd. 264
Synchronize with Trace View
Fit to Graph Area
Hide

Figure 3.93: Right Click on Graph Heading Dialog

Selecting Go to SCSI Cmd. 264 and Synchronize with Trace View will bring up both the Packet View and the associated Waveforms. See Figure 3.94.


File Setup Session Analysis Navigation View Window Help
Trainer
Recorc
Ch
Lnk Trp App CQ 10B 8B SC PV
Pending SCSI IO
Pending IOs(...
SCSI IO Throughput
Throughput (...
SCSI IO Latency Time
Operation Time
SCSI IO Response Time
Operation Time
200 400 600 800 1,000 1,200 1,400 1,600 1,800 2,000 2,200 2,400 2,600 2,800 3,000 3,200 3,400 3,600 3,800 4,000 4,200 4,400 4,600 4,800
Time (ms)
3 G
Metrics

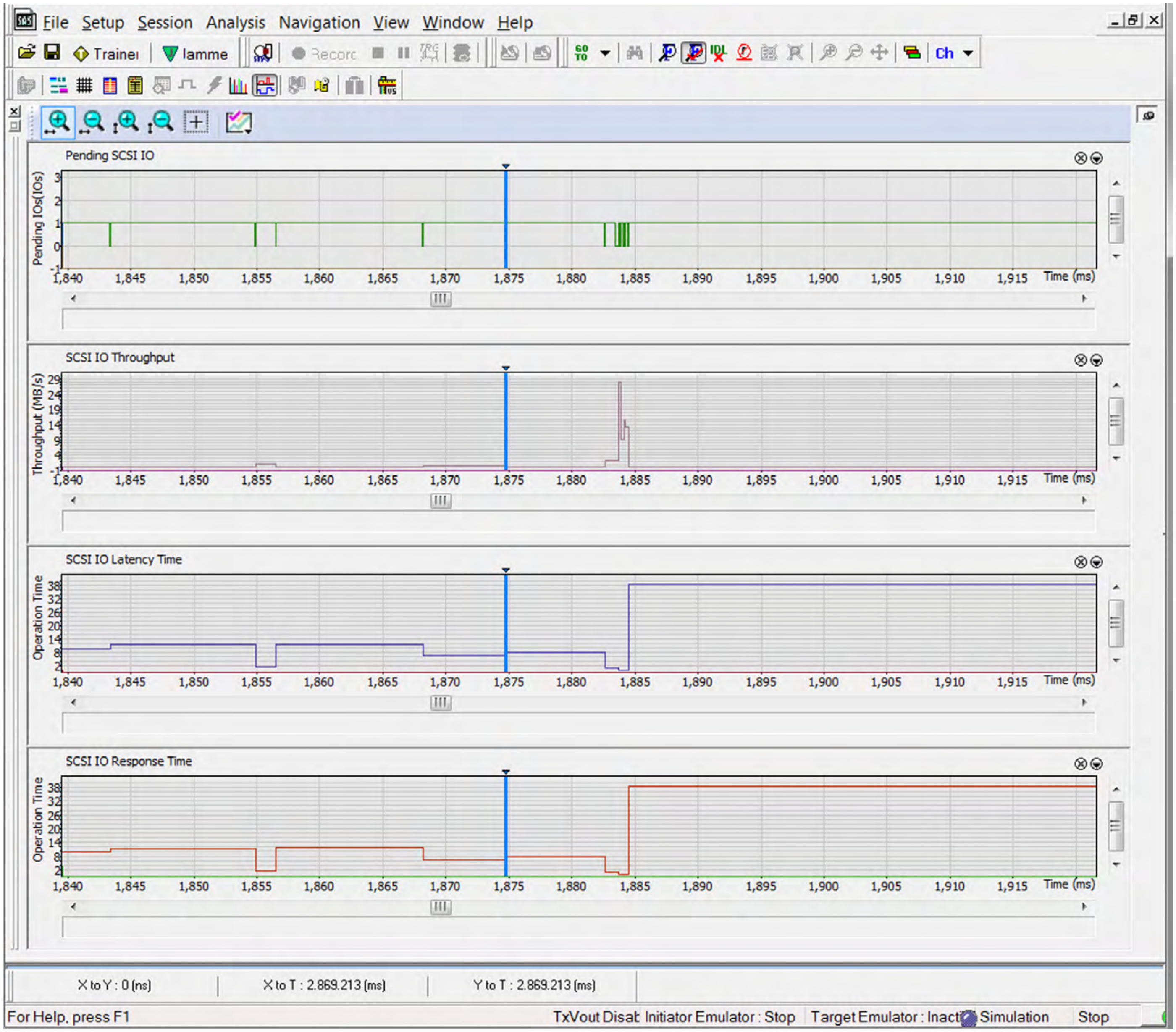
I2	SCSI Cmd.	Source Address (H)	Destination Address (H)	Operation Code	FUA_NV (H)	FUA (H)
1876.955120 (ms)	264	500062B000001074	5000C500001047B5	0x28 : Read (10)	0	0

DPO (H)	RDPROTECT (H)	Logical Block Address (H)	Group Number (H)	Transfer Length (D)	Control (H)	CDB Padding (H)
0	0	01FC84D3	00	4	00	000000000000

Payload Data , 2048 Bytes	Task Attribute	Tag (H)	Status	LUN (H)
00 00 00 00 00 00 00 00 00 00 00 00 >>	0x0 : Simple	01DF	0x00 : Good	0000000000000000

Figure 3.94: Packet View and Waveforms Synchronized

Then you can zoom in to the waveforms associated with the selected packet. See Figure 3.95 on page 185.


File Setup Session Analysis Navigation View Window Help
Trainer
Jammer
Record
Ch
Pending SCSI IO
Pending IOs(IOs)
SCSI IO Throughput
Throughput (MB/s)
SCSI IO Latency Time
Operation Time
SCSI IO Response Time
1,840 1,845 1,850 1,855 1,860 1,865 1,870 1,875 1,880 1,885 1,890 1,895 1,900 1,905 1,910 1,915 Time (ms)
For Help, press F1
TxVout Disab Initiator Emulator : Stop
Target Emulator : Inact
Simulation
Stop

X to Y : 0 (ns)
X to T : 2.869.213 (ms)
Y to T : 2.869.213 (ms)

Figure 3.95: Zoom In on Waveforms near the Selected Packet

Performance Reference Definitions

Trp. No. - Number of Transports

The total number of transports that compose this exchange.

Resp. Time - Response Time

The time taken to transmit this command on the link(s) from the beginning of the first frame in the command to the end of the last frame in the command.

Pld. Bytes - Payload Bytes

The number of payload bytes this operation transferred.

Latency Time

The time measured from the transmission of the command to the first data transmitted for this IO operation.

Data-Stat. Time - Data to Status Time

The time between the end of data transmission for this command and the Status frame.

Thrpt MB/s- Data Throughput

The payload divided by response time expressed in MB per second.

Duration

The time taken from the first DWord to the last DWord in a line.

Bus Utilization Buttons

The Bus Utilization window has a row of buttons for changing the format of the displayed data. The buttons have the following functions:

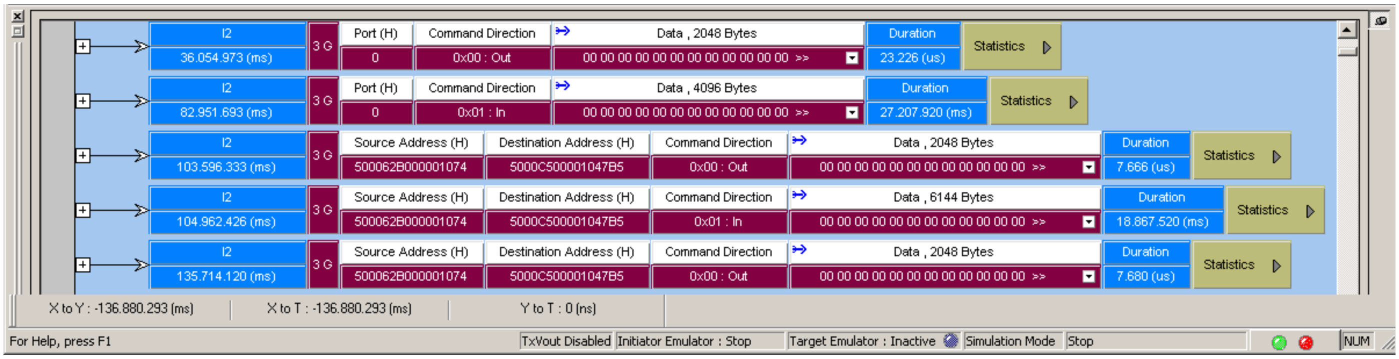
	Horizontal zoom in		Vertical zoom in
	Horizontal zoom out		Vertical zoom out
	Graph Areas Presents options for displaying additional graphs.		Click and Drag zoom Click diagonally to select and zoom in on part of the graph.
	Hide graph.		Graph legend (see previous page)

3.3.16 Data Report

When a captured sample is in the Sample Viewer, the Data Report button is on the Viewer toolbar, and Data Report is in the Report menu.

The data report displays all the data sent from the host to the device and from the device to the host. All PIO In => In commands are grouped as a data packet until the occurrence of a PIO Out => Out command, creating a new data packet.

To display a Data Report, click the **Data Report** button on the Viewer toolbar or select **Report > Data Report**.



I2 | 3 G | Port (H) | Command Direction | Data , 2048 Bytes | Duration | Statistics
36.054.973 (ms) | | 0 | 0x00 : Out | 00 00 00 00 00 00 00 00 00 00 00 00 >> | 23.226 (us)

I2 | 3 G | Port (H) | Command Direction | Data , 4096 Bytes | Duration | Statistics
82.951.693 (ms) | | 0 | 0x01 : In | 00 00 00 00 00 00 00 00 00 00 00 00 >> | 27.207.920 (ms)

I2 | 3 G | Source Address (H) | Destination Address (H) | Command Direction | Data , 2048 Bytes | Duration | Statistics
103.596.333 (ms) | | 500062B000001074 | 5000C500001047B5 | 0x00 : Out | 00 00 00 00 00 00 00 00 00 00 00 00 >> | 7.666 (us)

I2 | 3 G | Source Address (H) | Destination Address (H) | Command Direction | Data , 6144 Bytes | Duration | Statistics
104.962.426 (ms) | | 500062B000001074 | 5000C500001047B5 | 0x01 : In | 00 00 00 00 00 00 00 00 00 00 00 00 >> | 18.867.520 (ms)

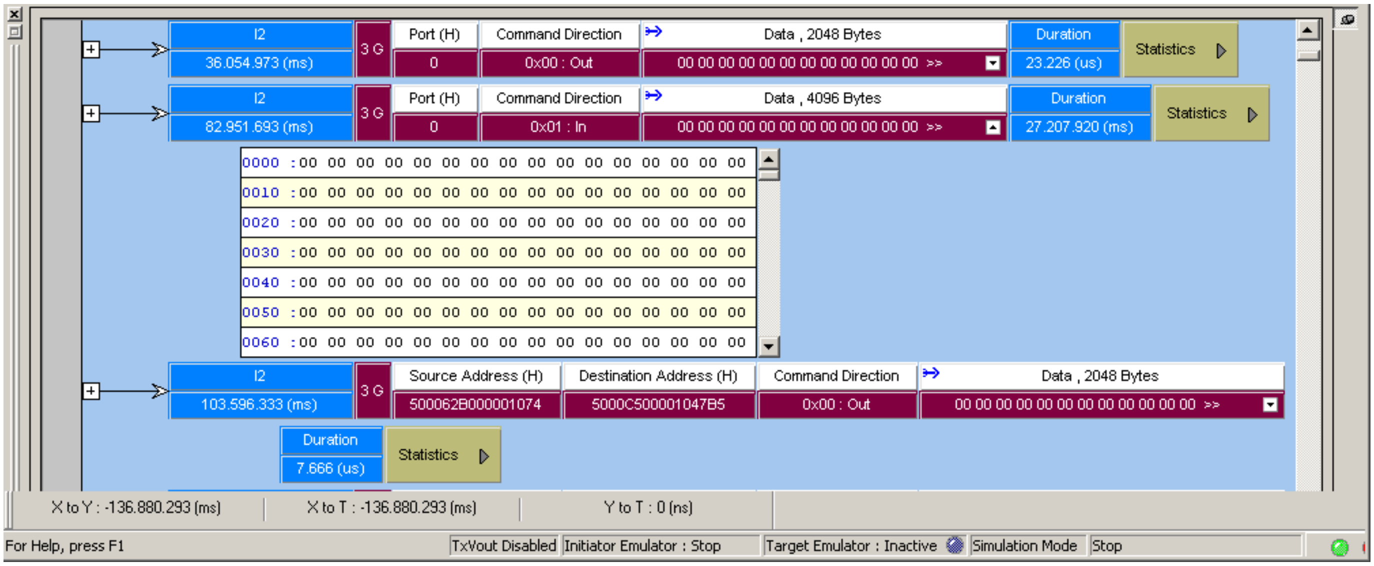
I2 | 3 G | Source Address (H) | Destination Address (H) | Command Direction | Data , 2048 Bytes | Duration | Statistics
135.714.120 (ms) | | 500062B000001074 | 5000C500001047B5 | 0x00 : Out | 00 00 00 00 00 00 00 00 00 00 00 00 >> | 7.680 (us)

X to Y : -136.880.293 (ms) X to T : -136.880.293 (ms) Y to T : 0 (ns)

For Help, press F1 TxVout Disabled Initiator Emulator : Stop Target Emulator : Inactive Simulation Mode Stop NUM

Figure 3.96: SAS: Data Report

Click the **Down Arrow** in a data field to display Data Report details (see Figure 3.97 on page 187).



I2 | 3 G | Port (H) | Command Direction | Data , 2048 Bytes | Duration | Statistics
36.054.973 (ms) | | 0 | 0x00 : Out | 00 00 00 00 00 00 00 00 00 00 00 00 >> | 23.226 (us)

I2 | 3 G | Port (H) | Command Direction | Data , 4096 Bytes | Duration | Statistics
82.951.693 (ms) | | 0 | 0x01 : In | 00 00 00 00 00 00 00 00 00 00 00 00 >> | 27.207.920 (ms)

```
0000 :00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0010 :00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0020 :00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0030 :00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0040 :00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0050 :00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0060 :00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

I2 | 3 G | Source Address (H) | Destination Address (H) | Command Direction | Data , 2048 Bytes
103.596.333 (ms) | | 500062B000001074 | 5000C500001047B5 | 0x00 : Out | 00 00 00 00 00 00 00 00 00 00 00 00 >>

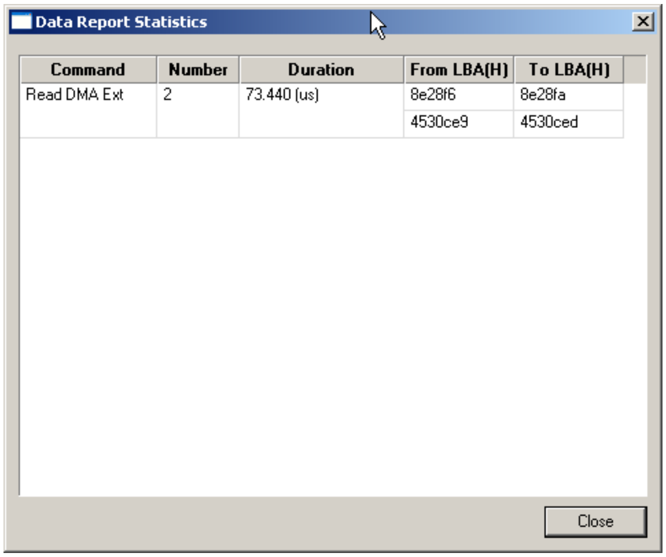
Duration | Statistics
7.666 (us)

X to Y : -136.880.293 (ms) X to T : -136.880.293 (ms) Y to T : 0 (ns)

For Help, press F1 TxVout Disabled Initiator Emulator : Stop Target Emulator : Inactive Simulation Mode Stop

Figure 3.97: SAS: Data Report Details

Click the **Statistics** button Statistics ▷ at the end of a row to display data report statistics.

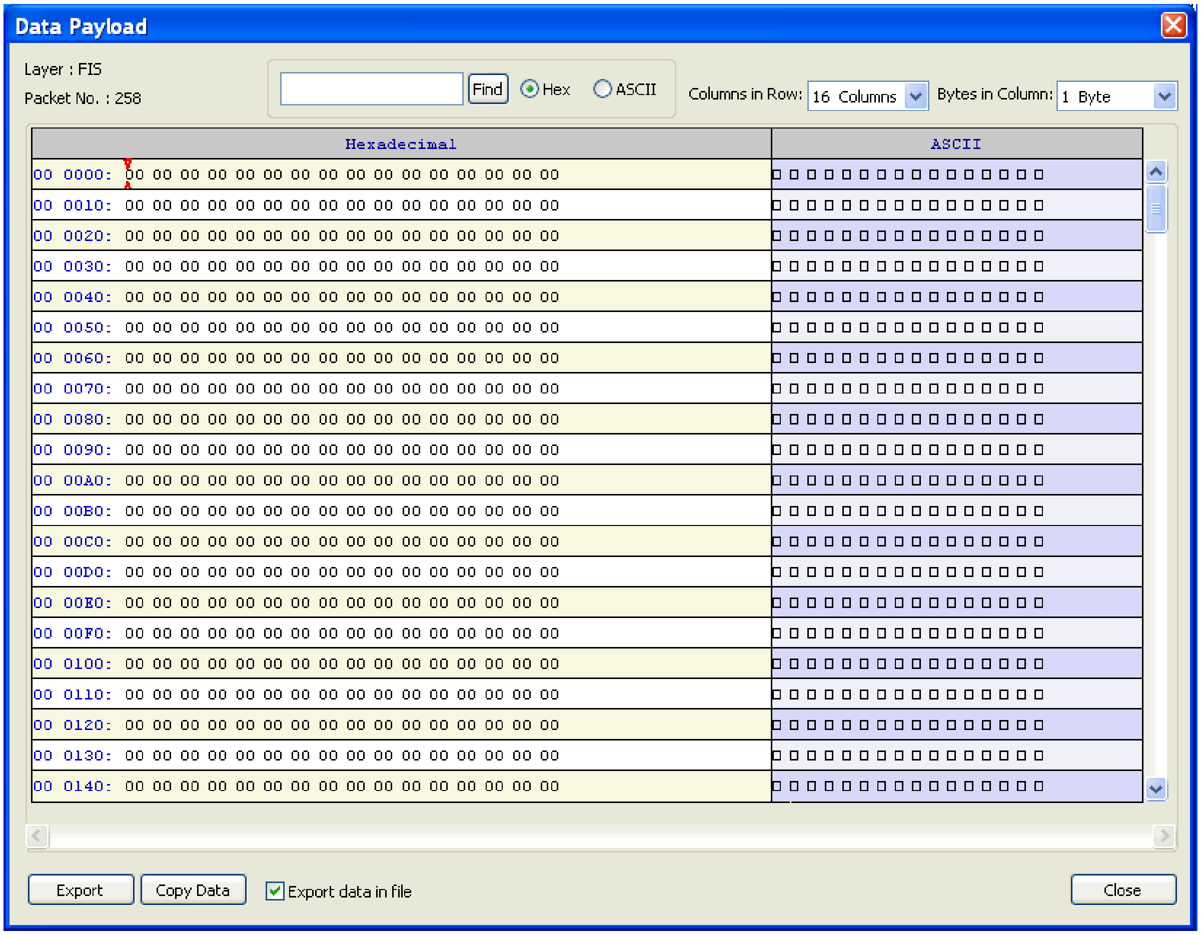


Command	Number	Duration	From LBA(H)	To LBA(H)
Read DMA Ext	2	73.440 (us)	8e28f6	8e28fa
			4530ce9	4530ced

Figure 3.98: SAS: Data Report Statistics

Data Payload View

To display the Data Payload View, double-click a data payload field in a Packet or Spreadsheet view, or right-click a data payload field and select **Open as Data View.** See the following screen capture:



Layer : FIS
Packet No. : 258
● Hex ○ ASCII
Columns in Row: 16 Columns
Bytes in Column: 1 Byte
☑ Export data in file

```
Hexadecimal                                               ASCII
00 0000: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  □□□□□□□□□□□□□□□□
00 0010: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  □□□□□□□□□□□□□□□□
00 0020: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  □□□□□□□□□□□□□□□□
00 0030: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  □□□□□□□□□□□□□□□□
00 0040: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  □□□□□□□□□□□□□□□□
00 0050: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  □□□□□□□□□□□□□□□□
00 0060: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  □□□□□□□□□□□□□□□□
00 0070: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  □□□□□□□□□□□□□□□□
00 0080: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  □□□□□□□□□□□□□□□□
00 0090: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  □□□□□□□□□□□□□□□□
00 00A0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  □□□□□□□□□□□□□□□□
00 00B0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  □□□□□□□□□□□□□□□□
00 00C0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  □□□□□□□□□□□□□□□□
00 00D0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  □□□□□□□□□□□□□□□□
00 00E0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  □□□□□□□□□□□□□□□□
00 00F0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  □□□□□□□□□□□□□□□□
00 0100: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  □□□□□□□□□□□□□□□□
00 0110: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  □□□□□□□□□□□□□□□□
00 0120: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  □□□□□□□□□□□□□□□□
00 0130: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  □□□□□□□□□□□□□□□□
00 0140: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  □□□□□□□□□□□□□□□□
```

Figure 3.99: Data Payload View

Note: When showing truncated data in the Data Payload View, the truncation points are marked with a separator placed between payloads. You can get more information about the data exclusion using the tooltip over the separator.

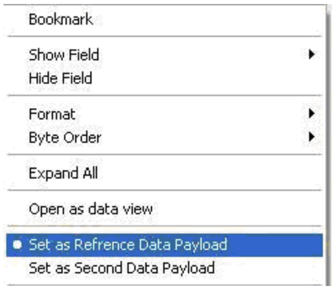
Note: You can control the number of bytes per line.

Find Data Pattern

To quickly locate a data pattern in the current frame, enter the pattern in the Text Box and click the **Find** button.

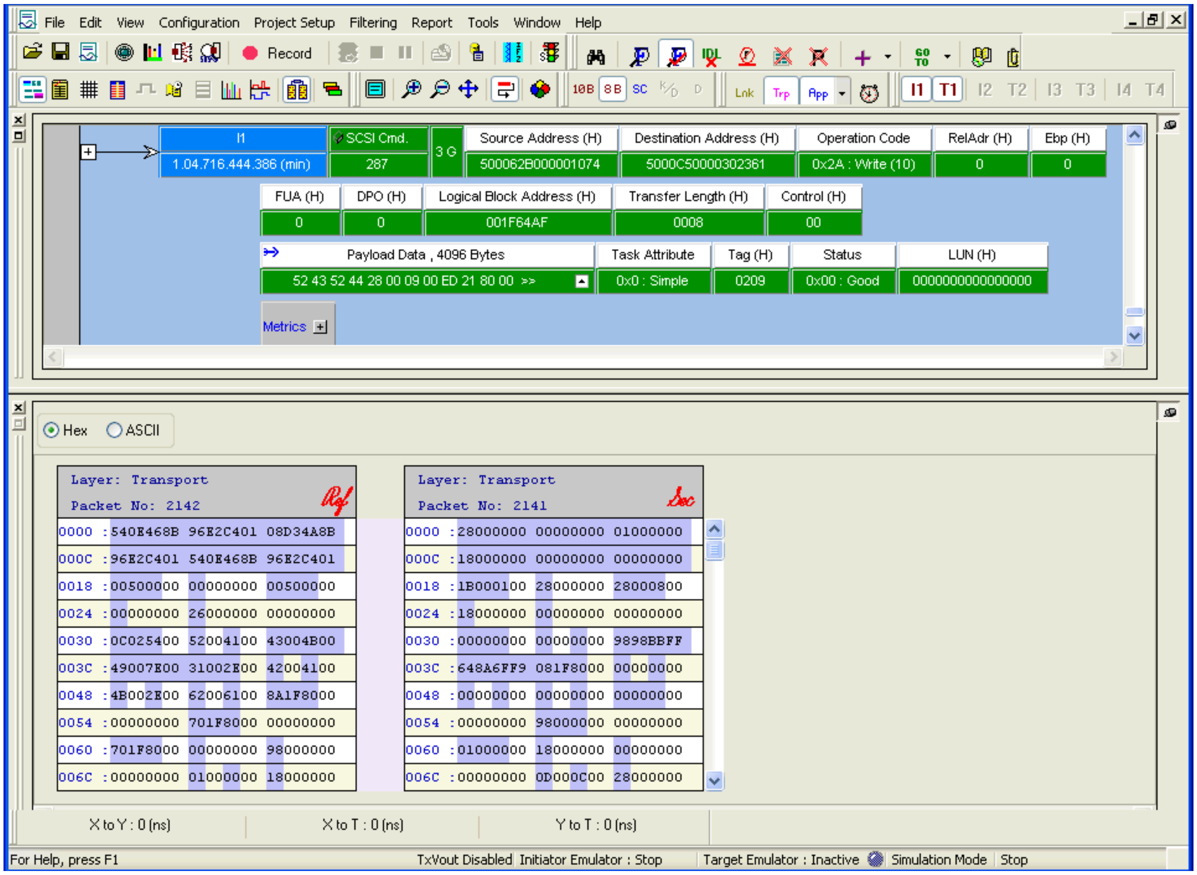
3.3.17 Compare Two Data Payloads

To compare two data payloads, select two different payload packets, one as reference. Right-click a payload field in Packet View or a related frame in Text View or Spreadsheet View to display a menu, then select **Set As Reference Data Payload**.


Bookmark
Show Field
Hide Field
Format
Byte Order
Expand All
Open as data view
Set as Refrence Data Payload
Set as Second Data Payload

Right-click a payload field in Packet View or a related frame in Text View or Spreadsheet View to display a menu, and choose **Set as Second Data Payload**.

To compare data payloads, click the **Show/Hide Compare 2 Data Payloads** button on the toolbar:


File Edit View Configuration Project Setup Filtering Report Tools Window Help
Record
10B 8B SC
Lnk Trp App
I1 T1 I2 T2 I3 T3 I4 T4
Metrics
Hex
ASCII
Ref
Sec

I1	SCSI Cmd.	3 G	Source Address (H)	Destination Address (H)	Operation Code	RelAdr (H)	Ebp (H)
1.04.716.444.386 (min)	287		500062B000001074	5000C50000302361	0x2A : Write (10)	0	0

FUA (H)	DPO (H)	Logical Block Address (H)	Transfer Length (H)	Control (H)
0	0	001F64AF	0008	00

Payload Data , 4096 Bytes	Task Attribute	Tag (H)	Status	LUN (H)
52 43 52 44 28 00 09 00 ED 21 80 00 >>	0x0 : Simple	0209	0x00 : Good	0000000000000000

```
Layer: Transport
Packet No: 2142
0000 :540E468B 96E2C401 08D34A8B
000C :96E2C401 540E468B 96E2C401
0018 :00500000 00000000 00500000
0024 :00000000 26000000 00000000
0030 :0C025400 52004100 43004B00
003C :49007E00 31002E00 42004100
0048 :4B002E00 62006100 8A1F8000
0054 :00000000 701F8000 00000000
0060 :701F8000 00000000 98000000
006C :00000000 01000000 18000000
```

```
Layer: Transport
Packet No: 2141
0000 :28000000 00000000 01000000
000C :18000000 00000000 00000000
0018 :1B000100 28000000 28000800
0024 :18000000 00000000 00000000
0030 :00000000 00000000 9898BBFF
003C :648A6FF9 081F8000 00000000
0048 :00000000 00000000 00000000
0054 :00000000 98000000 00000000
0060 :01000000 18000000 00000000
006C :00000000 0D000C00 28000000
```

X to Y : 0 (ns) X to T : 0 (ns) Y to T : 0 (ns)

For Help, press F1 TxVout Disabled Initiator Emulator : Stop Target Emulator : Inactive Simulation Mode Stop

Figure 3.100: Compare Two Data Payloads

3.4 Trace Expert

Trace Expert generates the following reports and analysis for the currently loaded trace:

- ❑ Performance Analysis
- ❑ Error Reports
- ❑ Trace Analysis Statistics
- ❑ Trace Information

To use Trace Expert, load a saved Trace that you are interested in examining. In this case the Trace "SAS 12G.scs" has been loaded. This trace is used as an example and may not be suitable for all analyzers, but the basic steps are the same for any analyzer.

Next, find the Trace Expert icon which is available from the Main Toolbar as shown in Figure 3.101 or the Analysis Toolbar (shown on Figure 3.5 on page 125).

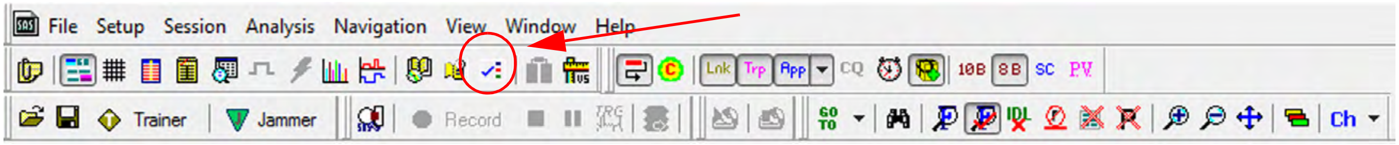
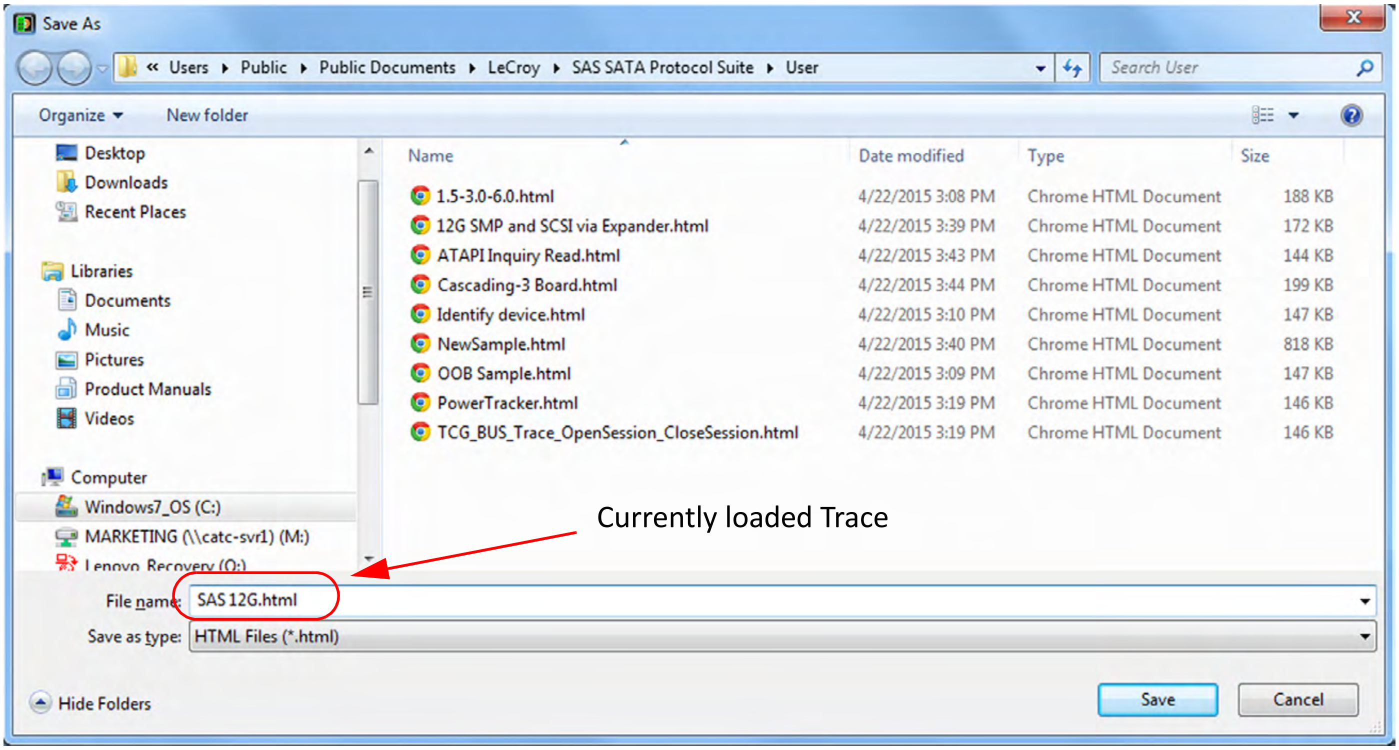

File
Setup
Session
Analysis
Navigation
View
Window
Help
Lnk
Trp
App
CQ
10B
8B
SC
PV
Trainer
Jammer
Record
Ch

Figure 3.101: Main Toolbar: Trace Expert Icon

Click on the Trace Expert icon, which generates the following pop-up dialog (Figure 3.102) showing all the Trace HTML files which contain the previously generated reports used by Trace Expert:


Save As
« Users ▸ Public ▸ Public Documents ▸ LeCroy ▸ SAS SATA Protocol Suite ▸ User
Search User
Organize ▾
New folder
Desktop
Downloads
Recent Places
Libraries
Documents
Music
Pictures
Product Manuals
Videos
Computer
Windows7_OS (C:)
MARKETING (\\catc-svr1) (M:)
Lenovo Recovery (Q:)
Hide Folders
Save
Cancel

Name	Date modified	Type	Size
1.5-3.0-6.0.html	4/22/2015 3:08 PM	Chrome HTML Document	188 KB
12G SMP and SCSI via Expander.html	4/22/2015 3:39 PM	Chrome HTML Document	172 KB
ATAPI Inquiry Read.html	4/22/2015 3:43 PM	Chrome HTML Document	144 KB
Cascading-3 Board.html	4/22/2015 3:44 PM	Chrome HTML Document	199 KB
Identify device.html	4/22/2015 3:10 PM	Chrome HTML Document	147 KB
NewSample.html	4/22/2015 3:40 PM	Chrome HTML Document	818 KB
OOB Sample.html	4/22/2015 3:09 PM	Chrome HTML Document	147 KB
PowerTracker.html	4/22/2015 3:19 PM	Chrome HTML Document	146 KB
TCG_BUS_Trace_OpenSession_CloseSession.html	4/22/2015 3:19 PM	Chrome HTML Document	146 KB

File name: SAS 12G.html

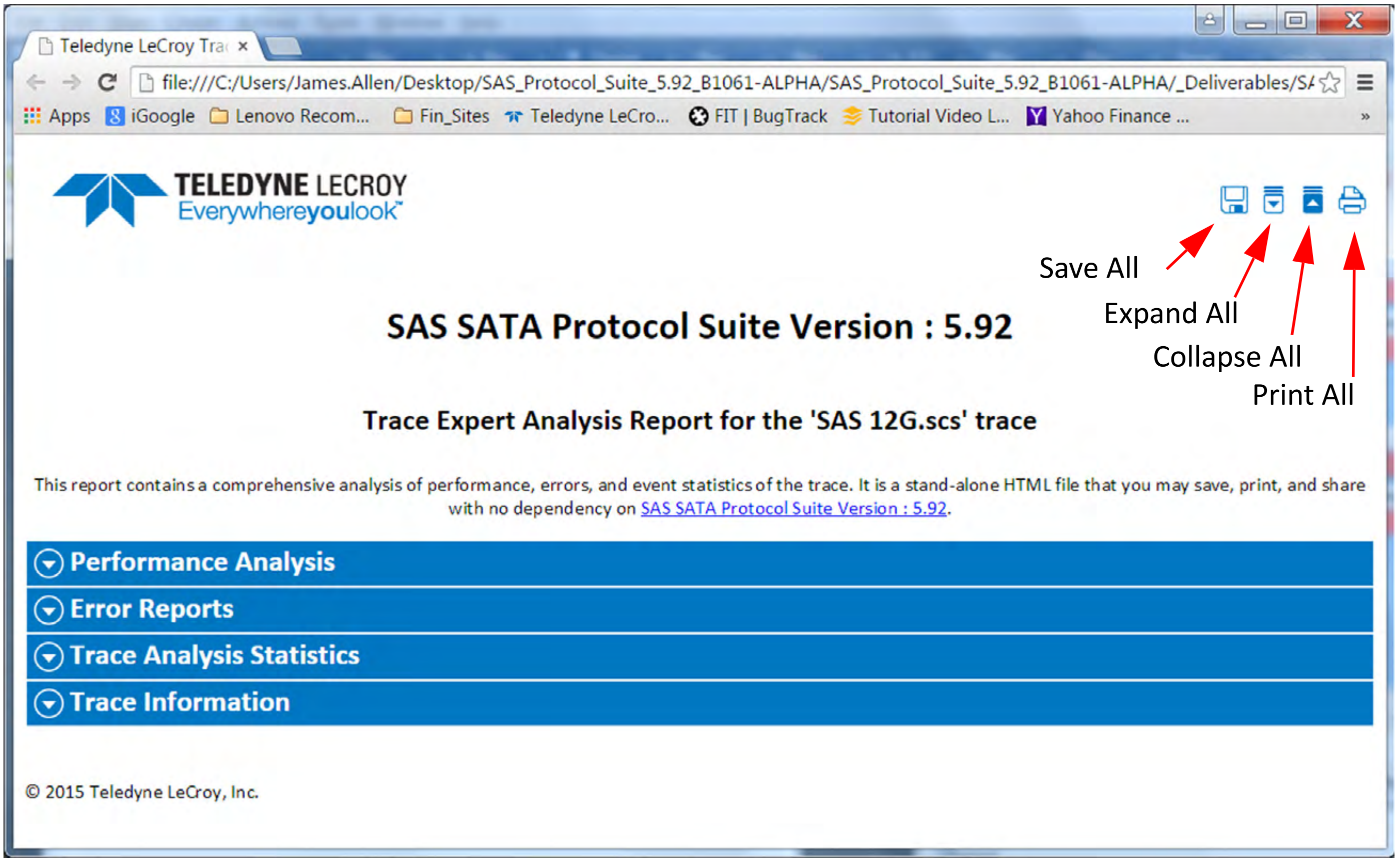
Save as type: HTML Files (*.html)

Currently loaded Trace

Figure 3.102: Trace Expert: Pop-Up Dialog

Click on the Save button to add the currently loaded Trace to the list of Saved Trace Expert HTML files. These HTML files can then be re-used. For example, the SAS 12G.html file (~150 KB containing all the Trace Expert reports and analysis for that Trace) could be emailed to a colleague or to Teledyne Customer Service without sending the whole Trace (~39 MB).

The Save process will also generate the SAS 12G Trace Expert HTML file with the following topics displayed for the loaded Trace (see Figure 3.103):


Teledyne LeCroy Tra ×
file:///C:/Users/James.Allen/Desktop/SAS_Protocol_Suite_5.92_B1061-ALPHA/SAS_Protocol_Suite_5.92_B1061-ALPHA/_Deliverables/S/
Apps
iGoogle
Lenovo Recom...
Fin_Sites
Teledyne LeCro...
FIT | BugTrack
Tutorial Video L...
Yahoo Finance ...
TELEDYNE LECROY
Everywhereyoulook™
Save All
Expand All
Collapse All
Print All
Performance Analysis
Error Reports
Trace Analysis Statistics
Trace Information

SAS SATA Protocol Suite Version : 5.92

Trace Expert Analysis Report for the 'SAS 12G.scs' trace

This report contains a comprehensive analysis of performance, errors, and event statistics of the trace. It is a stand-alone HTML file that you may save, print, and share with no dependency on SAS SATA Protocol Suite Version : 5.92.

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Figure 3.103: Trace Expert: Main Report Dialog

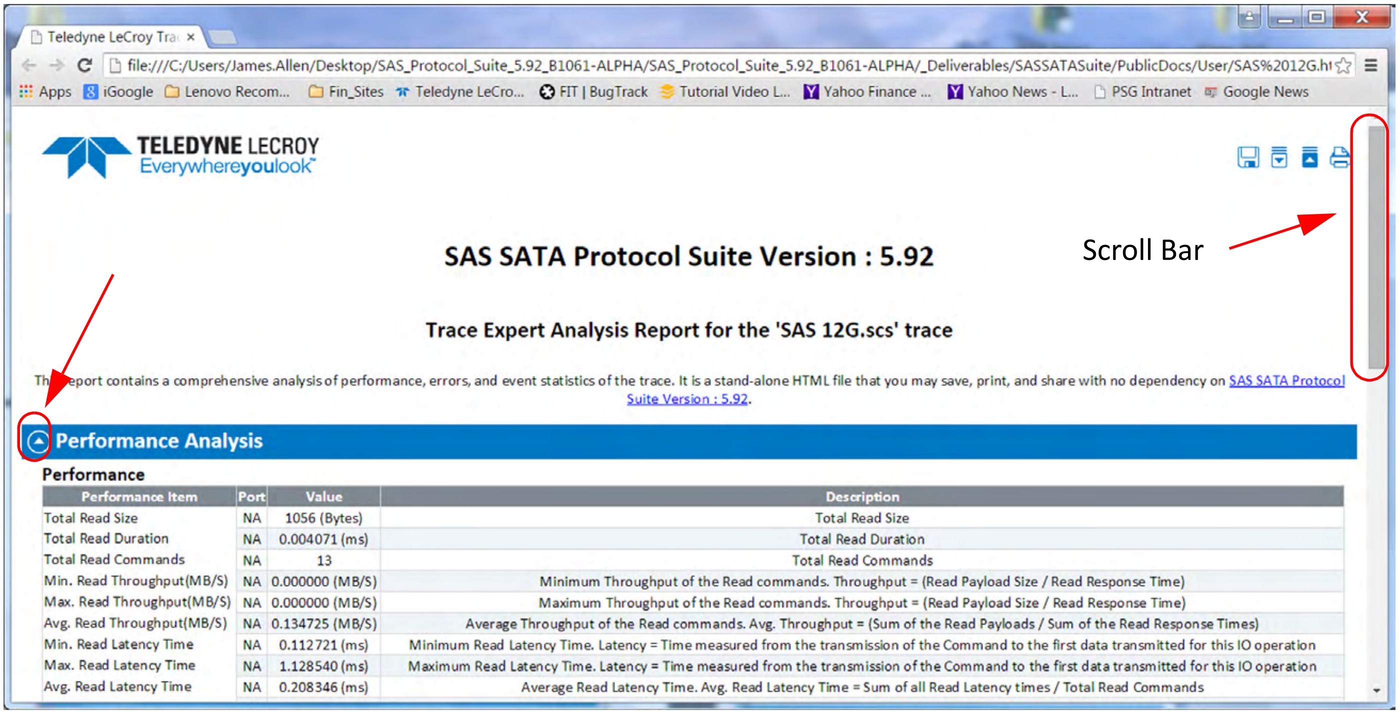
The main window has an Expand All button, a Collapse All button. a Print All button and a Save All button. The Save All button stores the Trace Expert html file to your Download folder.

You can select any of the four topics and information about that topic will be displayed.

If there is no information on any of the four topics, no report will be generated. For instance if no Errors were detected, no report would be generated and the Error Report menu option wouldn’t appear.

3.4.1 Performance Analysis

To view Performance Analysis click on that button. See Figure 3.104.


Teledyne LeCroy Tra
file:///C:/Users/James.Allen/Desktop/SAS_Protocol_Suite_5.92_B1061-ALPHA/SAS_Protocol_Suite_5.92_B1061-ALPHA/_Deliverables/SASSATASuite/PublicDocs/User/SAS%2012G.ht
Apps
iGoogle
Lenovo Recom...
Fin_Sites
Teledyne LeCro...
FIT | BugTrack
Tutorial Video L...
Yahoo Finance ...
Yahoo News - L...
PSG Intranet
Google News
TELEDYNE LECROY
Everywhereyoulook
Scroll Bar

SAS SATA Protocol Suite Version : 5.92

Trace Expert Analysis Report for the 'SAS 12G.scs' trace

Th eport contains a comprehensive analysis of performance, errors, and event statistics of the trace. It is a stand-alone HTML file that you may save, print, and share with no dependency on SAS SATA Protocol Suite Version : 5.92.

Performance Analysis

Performance

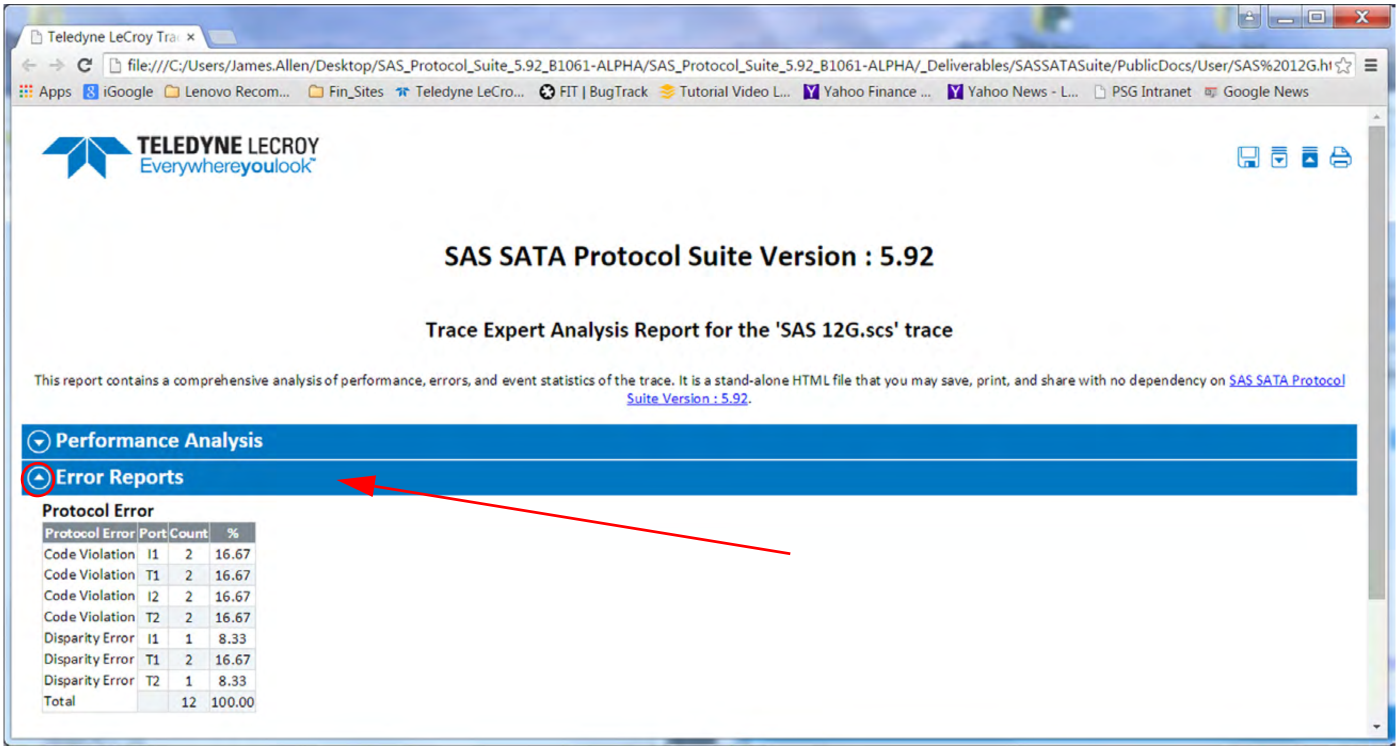
Performance Item	Port	Value	Description
Total Read Size	NA	1056 (Bytes)	Total Read Size
Total Read Duration	NA	0.004071 (ms)	Total Read Duration
Total Read Commands	NA	13	Total Read Commands
Min. Read Throughput(MB/S)	NA	0.000000 (MB/S)	Minimum Throughput of the Read commands. Throughput = (Read Payload Size / Read Response Time)
Max. Read Throughput(MB/S)	NA	0.000000 (MB/S)	Maximum Throughput of the Read commands. Throughput = (Read Payload Size / Read Response Time)
Avg. Read Throughput(MB/S)	NA	0.134725 (MB/S)	Average Throughput of the Read commands. Avg. Throughput = (Sum of the Read Payloads / Sum of the Read Response Times)
Min. Read Latency Time	NA	0.112721 (ms)	Minimum Read Latency Time. Latency = Time measured from the transmission of the Command to the first data transmitted for this IO operation
Max. Read Latency Time	NA	1.128540 (ms)	Maximum Read Latency Time. Latency = Time measured from the transmission of the Command to the first data transmitted for this IO operation
Avg. Read Latency Time	NA	0.208346 (ms)	Average Read Latency Time. Avg. Read Latency Time = Sum of all Read Latency times / Total Read Commands

Figure 3.104: Trace Expert: Performance Analysis

You can use the scroll bar to see more data.

3.4.2 Error Reports

To view the Error Report, click on the that button. See Figure 3.105.


Teledyne LeCroy Tra
file:///C:/Users/James.Allen/Desktop/SAS_Protocol_Suite_5.92_B1061-ALPHA/SAS_Protocol_Suite_5.92_B1061-ALPHA/_Deliverables/SASSATASuite/PublicDocs/User/SAS%2012G.ht
Apps
iGoogle
Lenovo Recom...
Fin_Sites
Teledyne LeCro...
FIT | BugTrack
Tutorial Video L...
Yahoo Finance ...
Yahoo News - L...
PSG Intranet
Google News
TELEDYNE LECROY
Everywhereyoulook
Performance Analysis
Error Reports

SAS SATA Protocol Suite Version : 5.92

Trace Expert Analysis Report for the 'SAS 12G.scs' trace

This report contains a comprehensive analysis of performance, errors, and event statistics of the trace. It is a stand-alone HTML file that you may save, print, and share with no dependency on SAS SATA Protocol Suite Version : 5.92.

Protocol Error

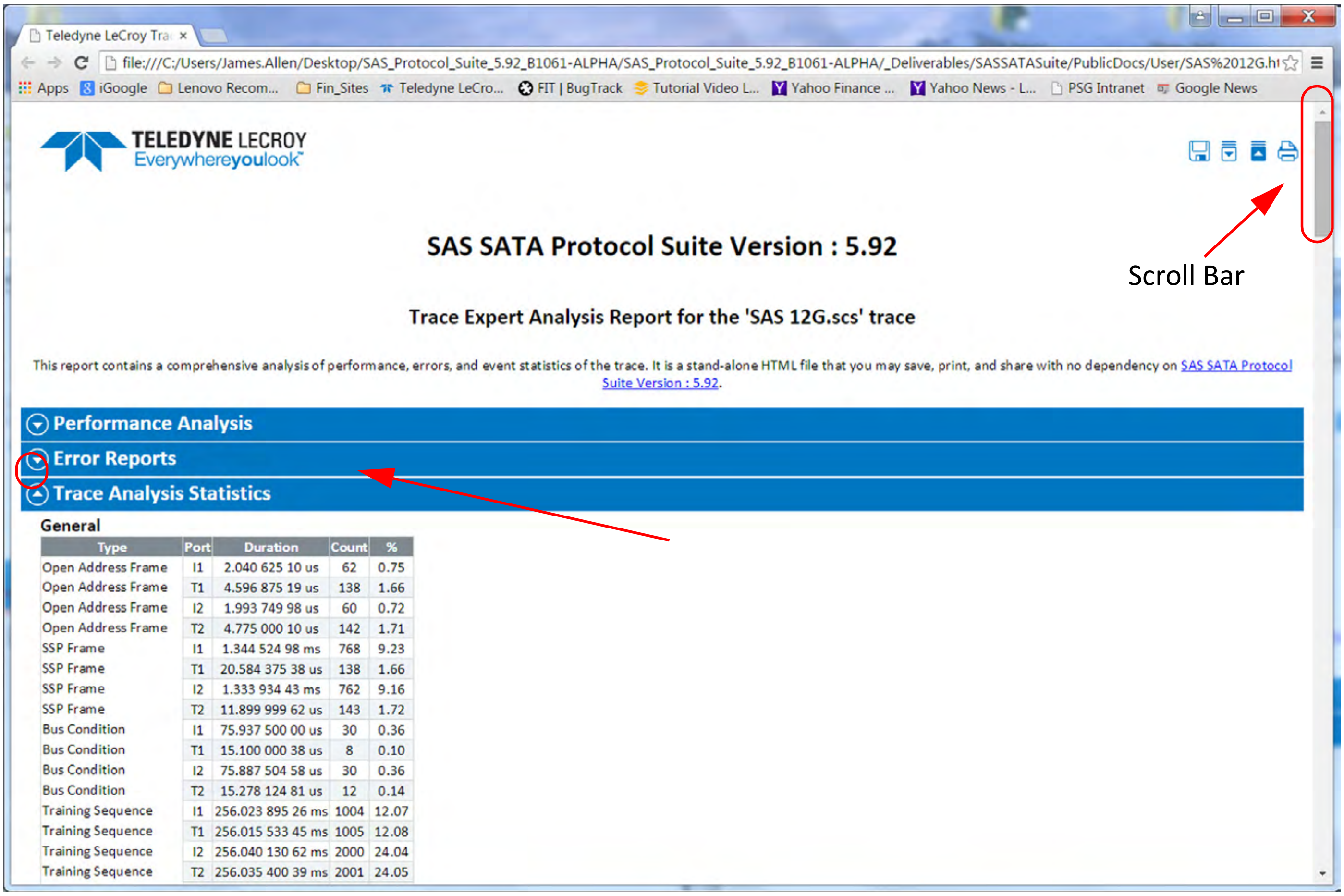
Protocol Error	Port	Count	%
Code Violation	I1	2	16.67
Code Violation	T1	2	16.67
Code Violation	I2	2	16.67
Code Violation	T2	2	16.67
Disparity Error	I1	1	8.33
Disparity Error	T1	2	16.67
Disparity Error	T2	1	8.33
Total		12	100.00

Figure 3.105: Trace Expert: Error Reports

You can use the scroll bar to see more data.

3.4.3 Trace Analysis Statistics

To view the Trace Analysis Statistics, click on the that button. See Figure 3.106.


Teledyne LeCroy Tra
file:///C:/Users/James.Allen/Desktop/SAS_Protocol_Suite_5.92_B1061-ALPHA/SAS_Protocol_Suite_5.92_B1061-ALPHA/_Deliverables/SASSATASuite/PublicDocs/User/SAS%2012G.ht
Apps
iGoogle
Lenovo Recom...
Fin_Sites
Teledyne LeCro...
FIT | BugTrack
Tutorial Video L...
Yahoo Finance ...
Yahoo News - L...
PSG Intranet
Google News
TELEDYNE LECROY
Everywhereyoulook
Scroll Bar

SAS SATA Protocol Suite Version : 5.92

Trace Expert Analysis Report for the 'SAS 12G.scs' trace

This report contains a comprehensive analysis of performance, errors, and event statistics of the trace. It is a stand-alone HTML file that you may save, print, and share with no dependency on SAS SATA Protocol Suite Version : 5.92.

Performance Analysis

Error Reports

Trace Analysis Statistics

General

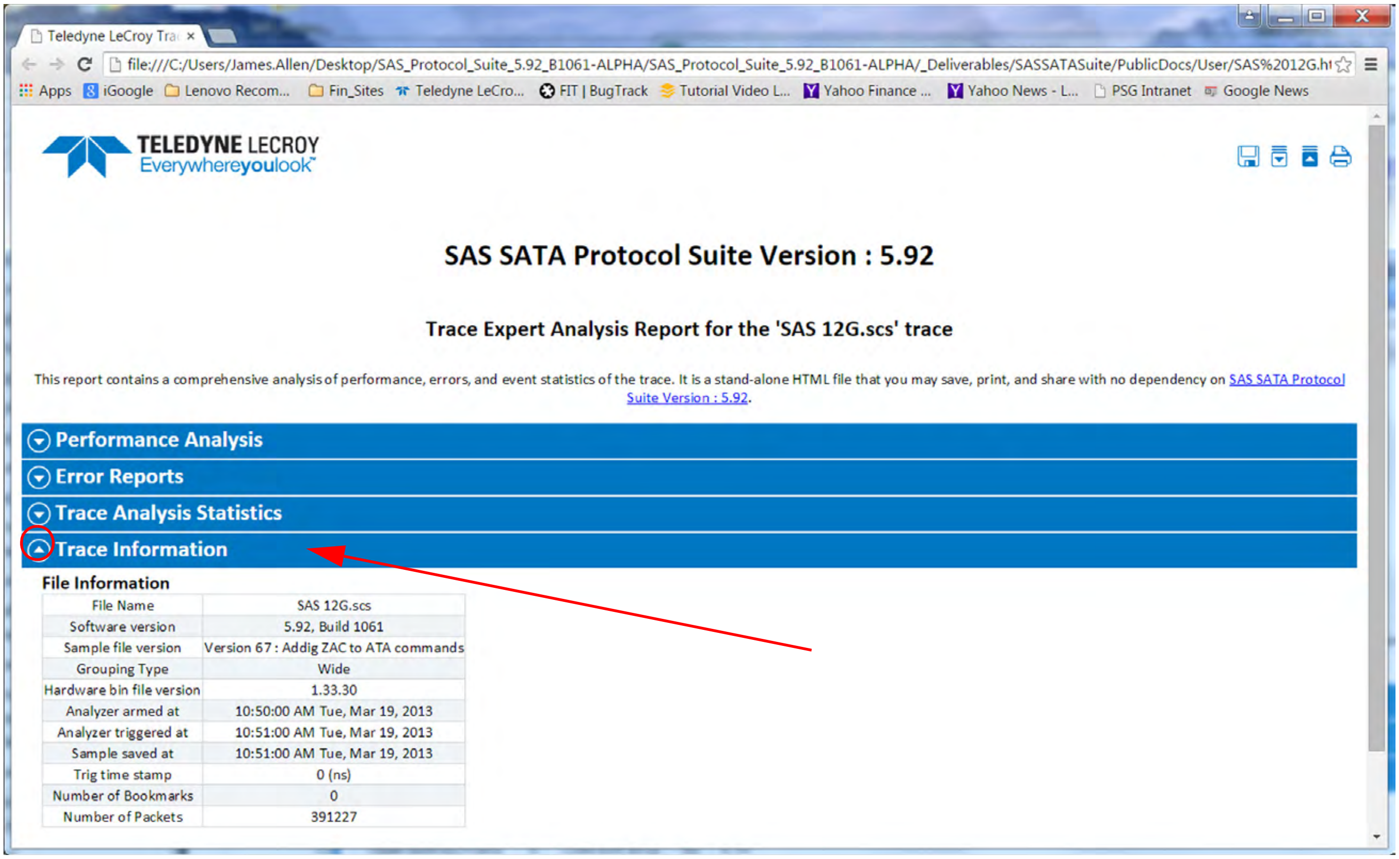
Type	Port	Duration	Count	%
Open Address Frame	I1	2.040 625 10 us	62	0.75
Open Address Frame	T1	4.596 875 19 us	138	1.66
Open Address Frame	I2	1.993 749 98 us	60	0.72
Open Address Frame	T2	4.775 000 10 us	142	1.71
SSP Frame	I1	1.344 524 98 ms	768	9.23
SSP Frame	T1	20.584 375 38 us	138	1.66
SSP Frame	I2	1.333 934 43 ms	762	9.16
SSP Frame	T2	11.899 999 62 us	143	1.72
Bus Condition	I1	75.937 500 00 us	30	0.36
Bus Condition	T1	15.100 000 38 us	8	0.10
Bus Condition	I2	75.887 504 58 us	30	0.36
Bus Condition	T2	15.278 124 81 us	12	0.14
Training Sequence	I1	256.023 895 26 ms	1004	12.07
Training Sequence	T1	256.015 533 45 ms	1005	12.08
Training Sequence	I2	256.040 130 62 ms	2000	24.04
Training Sequence	T2	256.035 400 39 ms	2001	24.05

Figure 3.106: Trace Expert: Trace Analysis Statistics

You can use the scroll bar to see more data.

3.4.4 Trace File Information

To view the Trace File Information, click on that button. See Figure 3.107.


Teledyne LeCroy Tra
file:///C:/Users/James.Allen/Desktop/SAS_Protocol_Suite_5.92_B1061-ALPHA/SAS_Protocol_Suite_5.92_B1061-ALPHA/_Deliverables/SASSATASuite/PublicDocs/User/SAS%2012G.ht
Apps
iGoogle
Lenovo Recom...
Fin_Sites
Teledyne LeCro...
FIT | BugTrack
Tutorial Video L...
Yahoo Finance ...
Yahoo News - L...
PSG Intranet
Google News
TELEDYNE LECROY
Everywhereyoulook™

SAS SATA Protocol Suite Version : 5.92

Trace Expert Analysis Report for the 'SAS 12G.scs' trace

This report contains a comprehensive analysis of performance, errors, and event statistics of the trace. It is a stand-alone HTML file that you may save, print, and share with no dependency on SAS SATA Protocol Suite Version : 5.92.

Performance Analysis
Error Reports
Trace Analysis Statistics
Trace Information

File Information

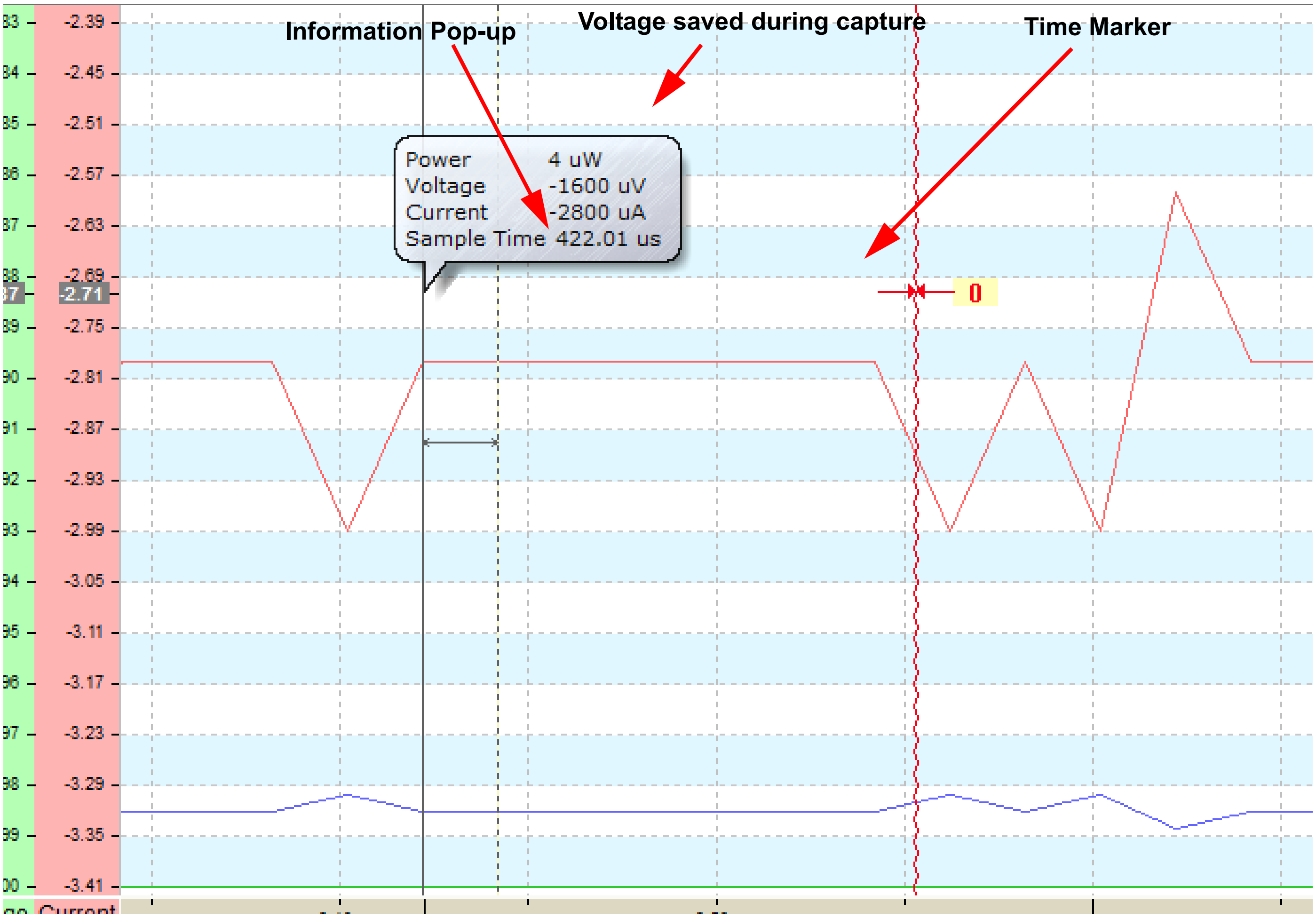
File Name	SAS 12G.scs
Software version	5.92, Build 1061
Sample file version	Version 67 : Addig ZAC to ATA commands
Grouping Type	Wide
Hardware bin file version	1.33.30
Analyzer armed at	10:50:00 AM Tue, Mar 19, 2013
Analyzer triggered at	10:51:00 AM Tue, Mar 19, 2013
Sample saved at	10:51:00 AM Tue, Mar 19, 2013
Trig time stamp	0 (ns)
Number of Bookmarks	0
Number of Packets	391227

Figure 3.107: Trace Expert: Trace File Information

3.5 Power Tracker View (SATA only)

Click the **Power Tracker View** button on the Viewer toolbar or select **Analysis > Power Tracker View**. The Power Tracker View displays all the power, current and voltage information captured while recording a trace as well as the sample time. See Power Management Setting on page 105 for more information.

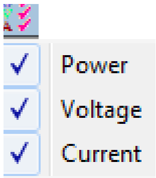
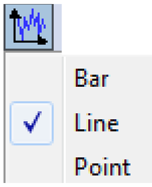
The power, voltage and current is displayed on the vertical axis and time on the horizontal axis. Hover anywhere over the view to display the information pop-up.


Information Pop-up
Voltage saved during capture
Time Marker
0
-2.39
-2.45
-2.51
-2.57
-2.63
-2.69
-2.71
-2.75
-2.81
-2.87
-2.93
-2.99
-3.05
-3.11
-3.17
-3.23
-3.29
-3.35
-3.41
Current

Power 4 uW
Voltage -1600 uV
Current -2800 uA
Sample Time 422.01 us

Figure 3.108: SATA: Power Tracker View

🔍	The **Zoom In** button on the toolbar magnifies the data display area on the screen.
🔍	The **Zoom In** button on the toolbar magnifies the data display area on the screen.
⬚	The **Zoom By Selection** button on the toolbar magnifies the user selected area in the view.
🔍	The **Zoom By H Drag** button on the toolbar magnifies the area selected by horizontally dragging and selecting in the view.
🔍	The **Zoom By V Drag** button on the toolbar magnifies the area selected by vertically dragging and selecting in the view.
✥	The **Full Screen** button on the toolbar Toggles between normal and full screen view.
↖	The **Pointer Mode** button on the toolbar changes the cursor to a pointer.
✋	The **Hand Panning** button on the toolbar changes the cursor to a hand for panning.

	The **Insert Time Marker** button on the toolbar enables inserting a time marker at selected spot in the view (see Figure 3.108 on page 197).
	The **Sync by Time** button on the toolbar toggles between synchronizing and un-synchronizing all the views by time.
	The **Show/Hide Power Tracker types: W, V, A** button on the toolbar allows the user to select the parameters to view from the list.
	The **Change Power Tracker graph type: W, V, A** button on the toolbar allows the user to select one of the three graph types to view from the list.
Unit 0 - 12 (Volt) Unit 0 - 12 (Volt)	Displays the voltage saved during trace capture. This is selected in the Power Management Setting dialog (see Power Management Setting on page 105).

3.6 Using the Power Expansion Card

You can use the Power Expansion Card to power the drives under test. See Using the Power Expansion Card on page 28.

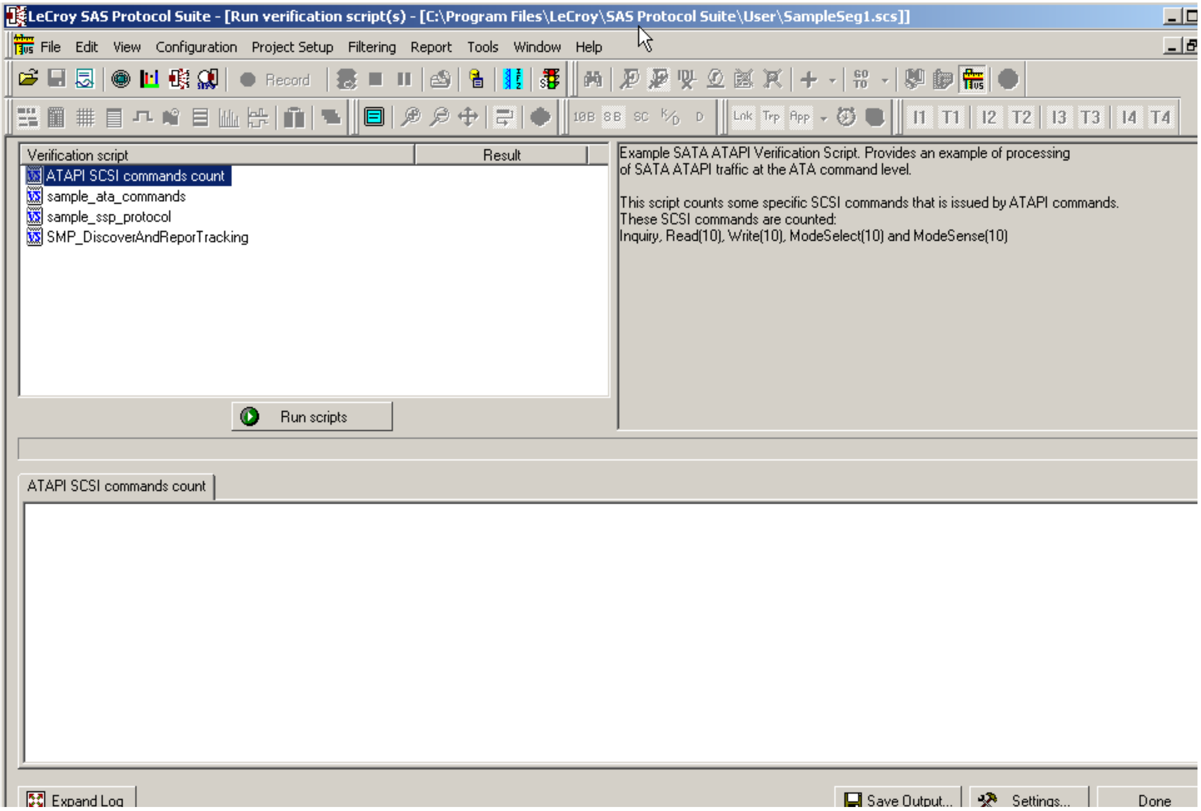
3.7 Running Verification Script Engine (VSE)

You can perform custom post-process analysis of the open trace by running a verification script over the trace. A verification script instructs the application to send trace and analysis information to the script. A verification script also contains script code, written using CATC Script Language (CSL) (see the **CSL_RefManual.pdf** document in the **docs** directory of the installation), used to process trace data and output that data in different formats.

Note: You may write your own verification scripts to perform custom verification and analysis. For information on how to write a verification script, see the *Verification Script Engine Reference Manual*.

To run a verification script over a trace:

1. Select the main menu item **Analysis > Verification script** or click the **Running verification scripts** button on the main tool bar. The Run Verification Scripts dialog opens, from which you choose and then run one or several verification scripts.


LeCroy SAS Protocol Suite - [Run verification script(s) - [C:\Program Files\LeCroy\SAS Protocol Suite\User\SampleSeg1.scs]]
File
Edit
View
Configuration
Project Setup
Filtering
Report
Tools
Window
Help
Record
Verification script
Result
Run scripts
Expand Log
Save Output...
Settings...
Done

ATAPI SCSI commands count
sample_ata_commands
sample_ssp_protocol
SMP_DiscoverAndReporTracking

Example SATA ATAPI Verification Script. Provides an example of processing of SATA ATAPI traffic at the ATA command level.

This script counts some specific SCSI commands that is issued by ATAPI commands. These SCSI commands are counted:
Inquiry, Read(10), Write(10), ModeSelect(10) and ModeSense(10)

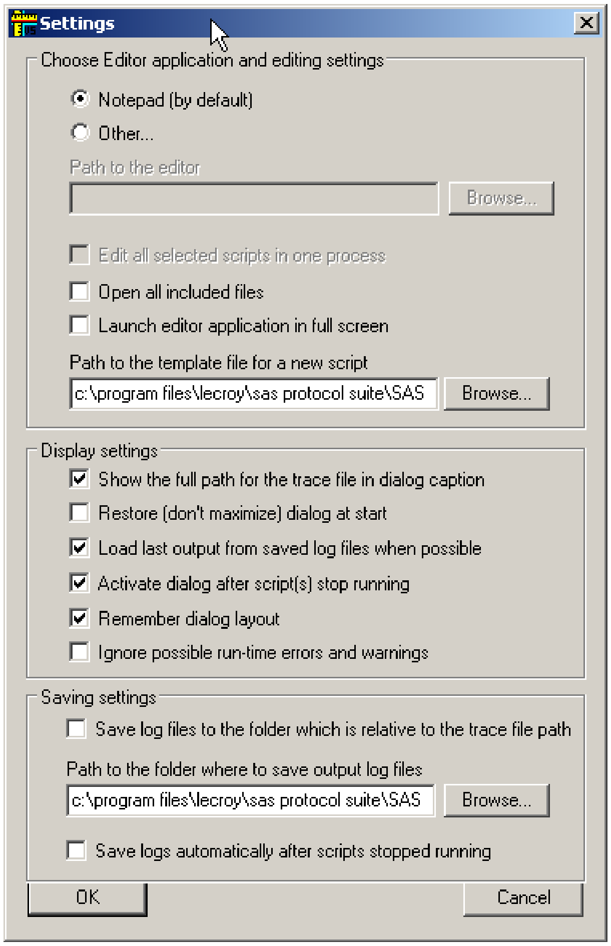
ATAPI SCSI commands count

Figure 3.109: Run Verification Scripts Dialog

To expand the Log window, click the **Expand Log** button. The Log window fills the whole window. To see the Verification Scripts window again, click the Collapse Log button.

To save output, click the **Save Output** button.

2. After choosing **Settings** from the drop-down list or the button, the Settings dialog displays:



Choose Editor application and editing settings

● Notepad (by default)

○ Other...

Path to the editor

☐ Edit all selected scripts in one process

☐ Open all included files

☐ Launch editor application in full screen

Path to the template file for a new script: c:\program files\lecroy\sas protocol suite\SAS

Display settings

☑ Show the full path for the trace file in dialog caption

☐ Restore (don't maximize) dialog at start

☑ Load last output from saved log files when possible

☑ Activate dialog after script(s) stop running

☑ Remember dialog layout

☐ Ignore possible run-time errors and warnings

Saving settings

☐ Save log files to the folder which is relative to the trace file path

Path to the folder where to save output log files: c:\program files\lecroy\sas protocol suite\SAS

☐ Save logs automatically after scripts stopped running

Figure 3.110: Run Verification Scripts - Settings Dialog

Choose the editor application: Notepad or other.

Edit all selected scripts in one process: If the editor supports multiple documents, you can edit all scripts in the editor.

Open all included files: You can edit included files, as well as the main script.

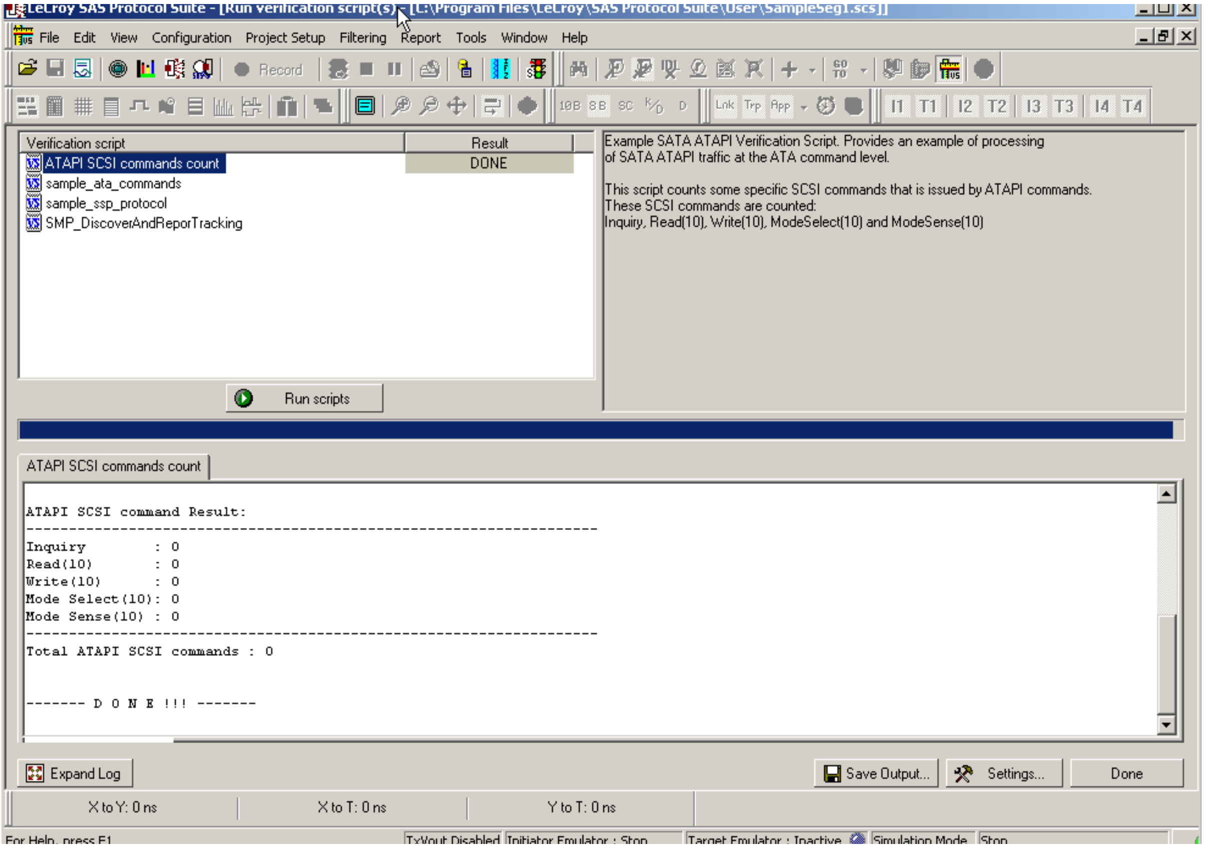
Launch editor application in full screen: You can use whole screen.

Path to the template file for a new script: You can use a template for the script.

Display Settings can show full trace-file path, restore dialog at start, load last output from save log files, activate dialog after scripts have run, remember dialog layout, and ignore errors and warnings.

Saving Settings can save log files to relative file folder, indicate output-log-file path, and save logs automatically.

3. Click the **Run scripts** button after you select scripts to run. VSE starts running the selected verification scripts, shows script report information in the output windows, and presents the results of verifications in the script list:


LeCroy SAS Protocol Suite - [Run verification script(s) - [C:\Program Files\LeCroy\SAS Protocol Suite\User\SampleSeg1.scs]]
File Edit View Configuration Project Setup Filtering Report Tools Window Help
Record
Verification script
Result
ATAPI SCSI commands count
DONE
sample_ata_commands
sample_ssp_protocol
SMP_DiscoverAndReporTracking
Run scripts
ATAPI SCSI commands count
Expand Log
Save Output...
Settings...
Done
X to Y: 0 ns
X to T: 0 ns
Y to T: 0 ns
For Help, press F1
TxVout Disabled
Initiator Emulator : Stop
Target Emulator : Inactive
Simulation Mode
Stop

Example SATA ATAPI Verification Script. Provides an example of processing of SATA ATAPI traffic at the ATA command level.

This script counts some specific SCSI commands that is issued by ATAPI commands. These SCSI commands are counted: Inquiry, Read(10), Write(10), ModeSelect(10) and ModeSense(10)

```
ATAPI SCSI command Result:
-------------------------------------------------------------------
Inquiry        : 0
Read(10)       : 0
Write(10)      : 0
Mode Select(10): 0
Mode Sense(10) : 0
-------------------------------------------------------------------
Total ATAPI SCSI commands : 0


------- D O N E !!! -------
```

Figure 3.111: Run Verification Scripts Dialog

4. Right-clicking in the script list displays some additional operations over selected scripts:

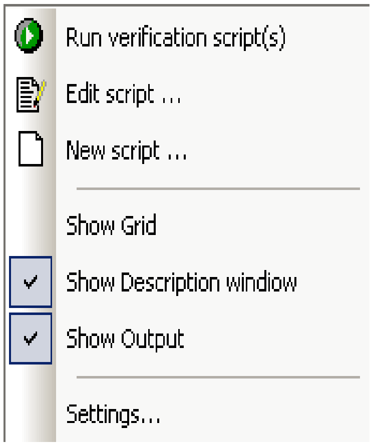

Run verification script(s)
Edit script ...
New script ...
Show Grid
✓ Show Description window
✓ Show Output
Settings...

Figure 3.112: Run Verification Scripts - Menu

Run verification script(s): Start running selected script(s).

Edit script: Edit selected scripts in the editor application specified in Editor settings.

New script: Create a new script file using the template specified in Editor settings.

Show Grid: Show/hide a grid in the verification script list.

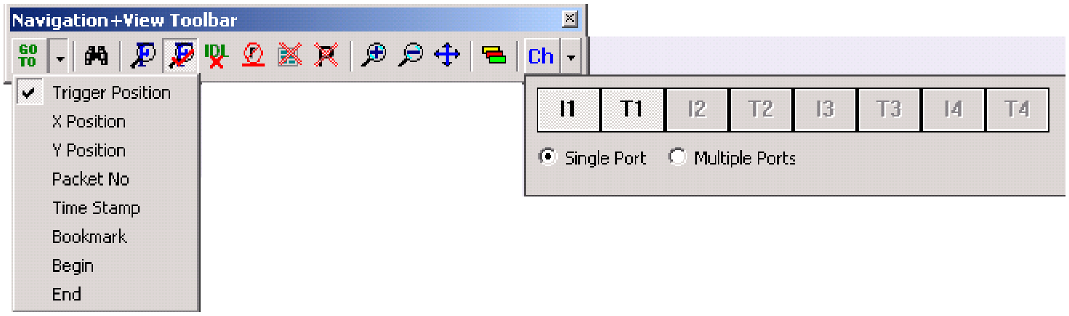
Show Description window: Show/hide the script description window (Shortcut key F2).

Show Output: Show/hide the script output windows (Shortcut key F3).

Settings: Open a special Setting dialog to specify different settings for VSE.

3.8 Navigation + View Toolbar

The Navigation + View toolbar allows you to navigate, search filter, hide RRDY/all primitives and unassociated traffic, zoom, tile views and select ports.



GO TO ▾	The down arrow on the **Go To** button allows location of cursors or specific packets: Trigger Position, X Position, Y Position, Packet Number, Timestamp, Bookmark, Begin, and End.
	The **Search** button opens the search dialog (see Search on page 219).
	The **Filtering Setup** button opens the Filter dialog (see Filtering on page 207) and allows you to specify the criteria for filtering the result.
	The **Enable Disable Filtering** button toggles the result between a filtered and unfiltered view (see Filtering on page 207).
IDL	The **Filter Idle** button toggles the display to show/hide idle packets (see Filtering on page 207).
	The **Hide RRDY Primitives** button toggles the display to show/hide RRDY primitives (see Filtering on page 207).
	The **Hide Unassociated Traffic** button toggles the display to show/hide unassociated traffic (see Filtering on page 207).
	The **Hide All Primitives** button toggles the display to show/hide all primitives (see Filtering on page 207). **Note:** When capturing PM traces, you need the ability to filter the PM primitives so you can find commands quicker.

	The **Zoom In** button on the Viewer Setting Toolbar magnifies the data display area on the screen. Clicking this button in Column or Text View increases column width only.
	The **Zoom Out** button on the Viewer Setting Toolbar scales the data display area to display more data lines on the screen. Clicking this button in Column or Text View decreases column width only.
	The **Normal Zoom** button on the Viewer Setting Toolbar resets the zoom to default normal on the screen. Clicking this button in Column or Text View resets column width only.
	You can use **Tile Horizontally All Views icon** or select **View > Tile Views** to revert any unintended window docking or sizing, or maximize screen utilization. This function only tiles views inside a trace window. Note that there is no command to tile views vertically.

3.8.1 Go To Menu

Locate Cursors

To quickly locate any cursor within the data viewer display, click the **Go To** button and choose the cursor to locate. You can also locate a cursor by selecting **Go To** from the Edit menu and choosing the cursor to locate.

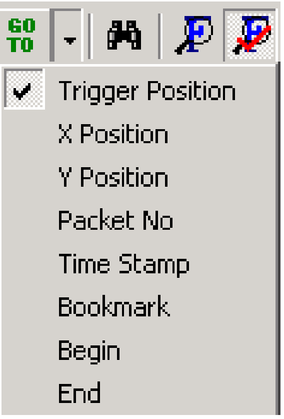


Figure 3.113: Locate Cursor

Go to Time Stamp

To locate a timestamp, click the **Go To** button and choose **Timestamp**.

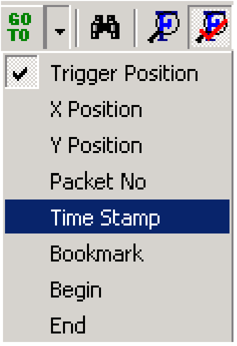
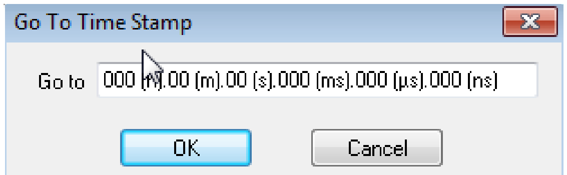

GO TO
✓ Trigger Position
X Position
Y Position
Packet No
Time Stamp
Bookmark
Begin
End

Figure 3.114: Time Stamp

Enter a time stamp value in the Go To Timestamp dialog and click **OK**.


Go To Time Stamp
OK
Cancel

Go to 000 (h).00 (m).00 (s).000 (ms).000 (µs).000 (ns)

Figure 3.115: Go to Time Stamp

Bookmarks

Bookmarks are a convenient way to mark a point in the data viewer display by name, so that you can rapidly return to that point. To create a bookmark, right-click the mouse in the data viewer area on a packet in which to place the bookmark.

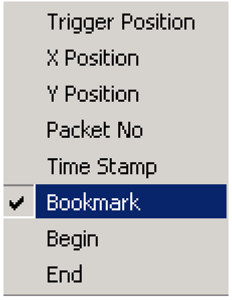

Trigger Position
X Position
Y Position
Packet No
Time Stamp
✓ Bookmark
Begin
End

Figure 3.116: Bookmark

Click **Bookmark** from the fly out menu to open the Bookmark Dialog (see Figure 3.116 on page 204).

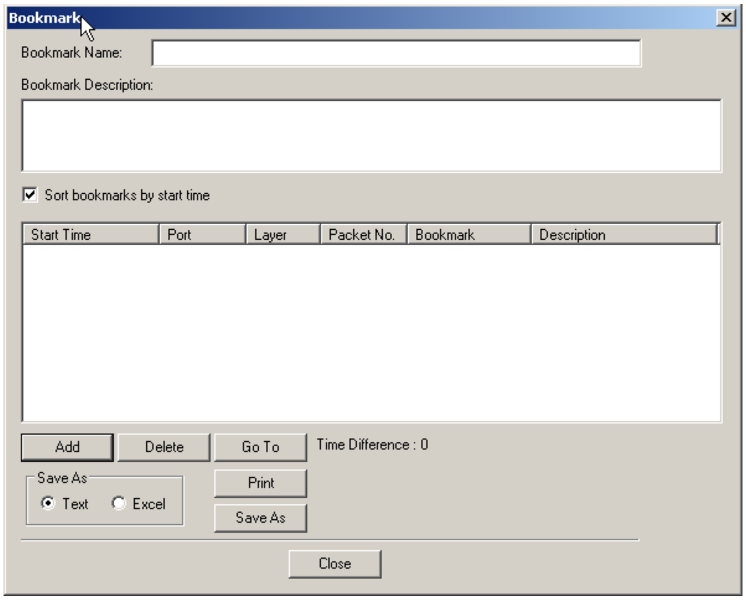

Bookmark
Bookmark Name:
Bookmark Description:
☑ Sort bookmarks by start time
Start Time
Port
Layer
Packet No.
Bookmark
Description
Add
Delete
Go To
Time Difference : 0
Save As
● Text
○ Excel
Print
Save As
Close

Figure 3.117: Bookmark Dialog

Enter a description for the bookmark and click the **Add** button. Repeat for additional **bookmarks.**

You can save the bookmark as a text file or Excel CSV file.

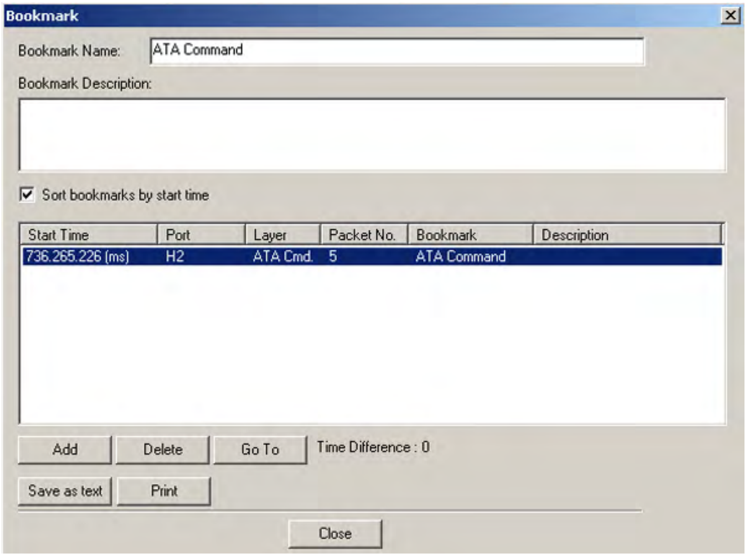
Note: Column View has a different bookmark mechanism than other views, and you can set a bookmark on each DWORD in the view. This makes Column View bookmarks unavailable in other views and vice versa.

Editing a Bookmark

If a packet has a bookmark, you can edit the bookmark by right-clicking the data viewer area of the packet, selecting the **Edit Bookmark** command from the pop-up menu, and changing the information in the Bookmark dialog (see above).

Finding a Bookmark

To find a bookmark in the data viewer display, right-click the mouse in the sample viewer and select **Bookmark** (see Figure 3.118 on page 206).


Bookmark
Add
Delete
Go To
Save as text
Print
Close

Bookmark Name: ATA Command

Bookmark Description:

☑ Sort bookmarks by start time

Start Time	Port	Layer	Packet No.	Bookmark	Description
736.265.226 (ms)	H2	ATA Cmd.	5	ATA Command	

Time Difference : 0

Figure 3.118: Go To Bookmark Dialog Box

Highlight the bookmark to which to go, then click the **Go To** button, or double-click the selection.

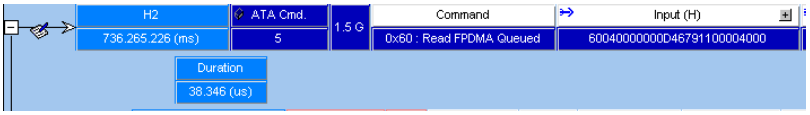

H2
736.265.226 (ms)
ATA Cmd.
5
1.5 G
Command
0x60 : Read FPDMA Queued
Input (H)
60040000000D46791100004000
Duration
38.346 (us)

Figure 3.119: Bookmark Found Example in Data Viewer Display

Bookmark Description

To get a quick description of a displayed bookmark, position the tool tip over a bookmark. The name and description of the bookmark display.

Set Time Stamp Origin

Right-click in the sample viewer to open the fly out menu (see Figure 3.120):

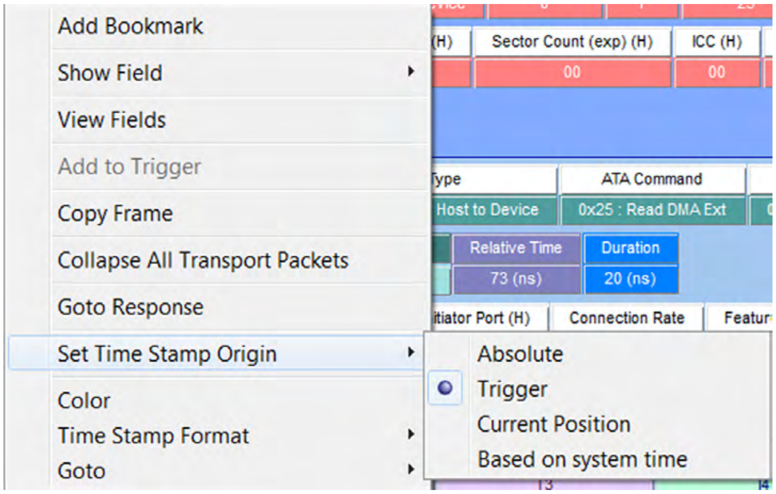

Add Bookmark
Show Field
View Fields
Add to Trigger
Copy Frame
Collapse All Transport Packets
Goto Response
Set Time Stamp Origin
Color
Time Stamp Format
Goto
Absolute
Trigger
Current Position
Based on system time
Sector Count (exp) (H)
00
ICC (H)
00
ATA Command
Host to Device
0x25 : Read DMA Ext
Relative Time
73 (ns)
Duration
20 (ns)
Connection Rate

Figure 3.120: Set Time Stamp Origin: Trigger.

Highlight **Set Time Stamp Origin** and choose either Absolute, Trigger, Current Position, or Based on system time.

Example: Trigger Mode

An example Trace showing the Time Stamp set to Trigger Mode in both the Packet View and the Column View is shown below in Figure 3.121.

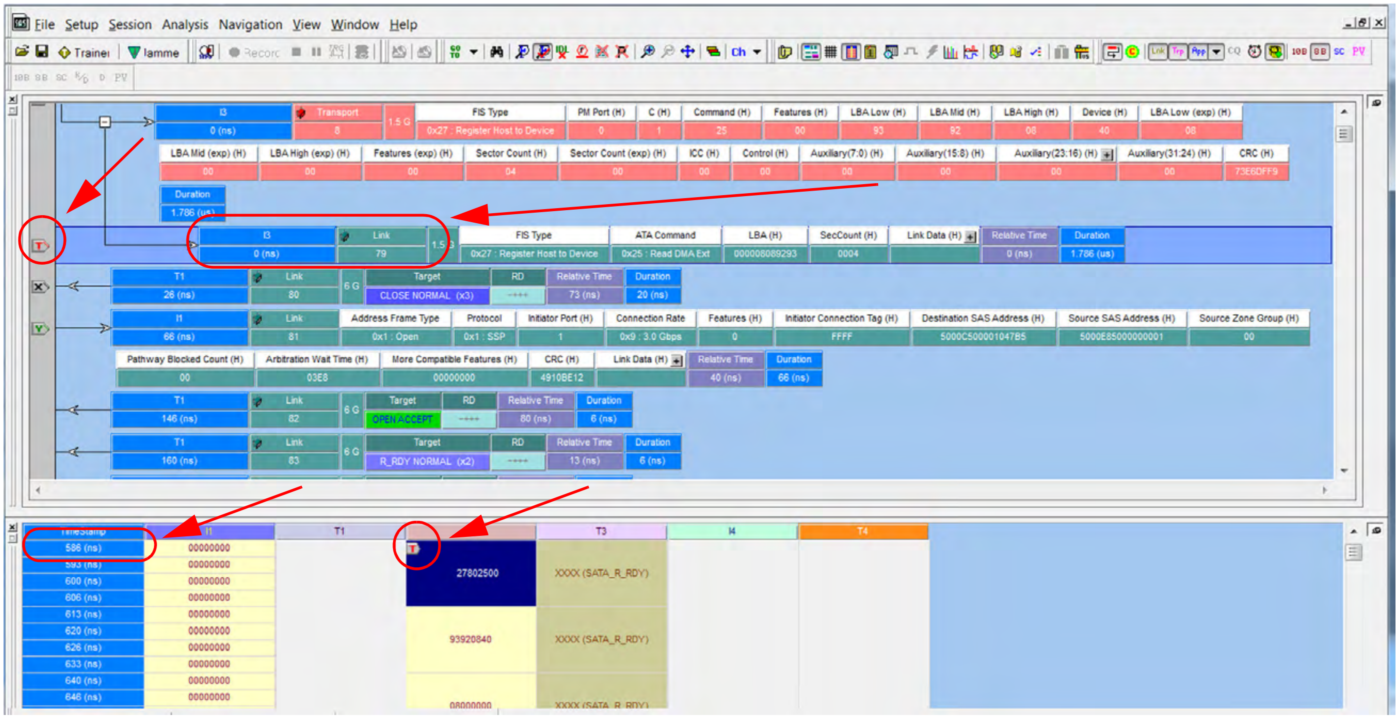


Figure 3.121: Time Stamp Set to Trigger

In the Packet View (upper pane) the Red T for Trigger shows that the trigger occurs within Packet 79 and setting the Time Stamp to Trigger shows 0 ns.

In the Column View (lower pane) the Red T for Trigger shows that the trigger occurs 566ns within Packet 79. The reason the two trigger times are different is because the Column View is more accurate. The Packet View tells you that the trigger occurs within Packet 79, but the Column View tells you that the trigger occurs 566ns after the start of the packet.

3.8.2 Filtering

The Filtering menu and options allow you to modify data in the sample viewer display to exclude packets with a set of user-defined patterns and show the results in all views.

To set up filtering, you must have a viewer display open.

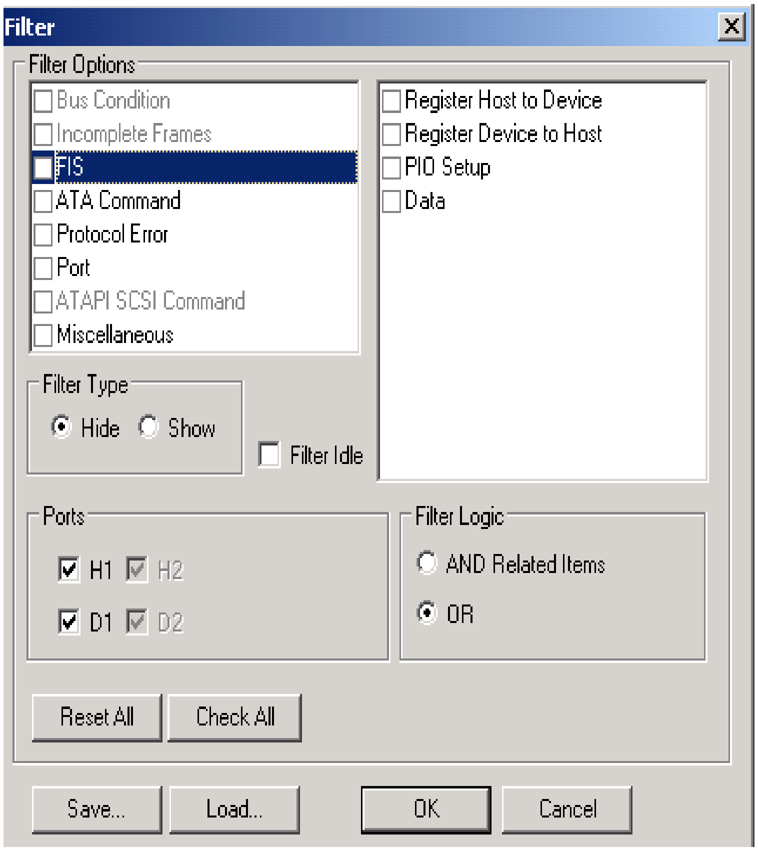
The Filtering menu has the options:

- Enable Filtering (see Enable Filter on page 218)
- Filtering (see Filter Setup on page 208)
- Link Layer (SAS)
- Transport Layer (SAS)

- Application Layer (SAS)
- Physical Layer (SATA)
- FIS Layer (SATA)
- Command Layer (SATA)
- Filter Idles (see Filter Idle on page 218)

3.8.3 Filter Setup

To display the Filter setup dialog, click the **Filter** button on the Viewer toolbar or select **View > Filtering**.



Filter

Filter Options

☐ Bus Condition
☐ Incomplete Frames
☐ FIS
☐ ATA Command
☐ Protocol Error
☐ Port
☐ ATAPI SCSI Command
☐ Miscellaneous

☐ Register Host to Device
☐ Register Device to Host
☐ PIO Setup
☐ Data

Filter Type: ● Hide ○ Show

☐ Filter Idle

Ports: ☑ H1 ☑ H2 ☑ D1 ☑ D2

Filter Logic: ○ AND Related Items ● OR

Figure 3.122: SAS/SATA: Filter Setup Dialog

You can select or deselect each of the items shown in the Filter Options window for filtering, by checking or unchecking a corresponding check box. Items not in the current sample are in shade. See Selectable Filter Options for SAS on page 212 and Selectable Filter Options for SATA on page 217

Note: If you select a group, that also selects all child items.

Note: Only packets captured at run time are available for selection for filtering.

Filter Type

You can choose to show or hide the Filter Type items by checking the **Show** or **Hide** option button.

Note: When capturing PM traces, you need the ability to filter the PM primitives so you can find commands quicker.

Filtering Direction

You can select items for filtering in a single direction or both directions by checking the corresponding Port. By default, all ports are enabled. Uncheck the port check boxes for ports not to include in the filter.

Filter Idle

Depending on the Filter Type (Hide/Show), Idle packets in the Sample Viewer are shown or hidden.

Save Filter Setup

After you have set up a Filter configuration, you can save it as an SAS Filter file (***sfl**) or SATA Filter file (***.tfl**) by clicking **Save**. You can then use it on a different capture by clicking **Load** in the Filter dialog.

Filter Logic

After you have set up Filter options, you can set filter logic to **And Related Items** to apply “AND” logic on related selected options (for example, SCSI commands and SAS Addresses) or **OR** to apply “OR” logic on all selected options.

After you have set up Filter options, you can set filter logic to **And Related Items** to apply "AND" logic on related selected options (for example, SCSI commands and SAS Addresses) or **OR** to apply "OR" logic on all selected options.

Filter only applies to entities in a trace. When you choose SCSI command **AND** SSP frame, for instance, Filter affects all entities in the trace that are SCSI commands, **AND** are SSP frames. Any SCSI commands that are **NOT** SSP frames, will not, in this case, be filtered.

If you choose **OR**, Filter affects all entities that are SCSI commands, as well as all SSP frames.

The AND operator is only applicable for some cases, such as:

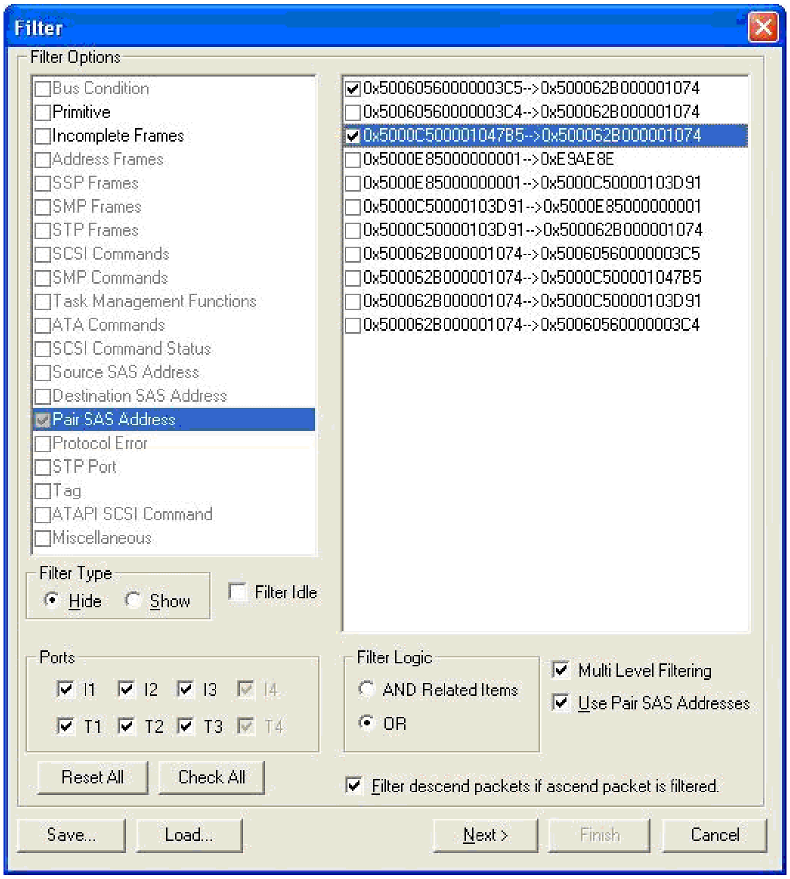
- ☐ A SCSI command AND a Tag.
- ☐ A SCSI command AND a source/destination address.

For example, when you choose a SCSI command AND a tag = 0x1, you will filter all entities on a trace that are SCSI commands that have tags equal to "0x1" in that SCSI command.

As a general rule, it is not possible to apply AND to two packet types (frames, commands, primitives, training sequences or bus conditions). It only works when you apply AND to one packet type with other items such as source/Destination Addresses, TAG, Task attribute.

Multilevel Filtering in SAS

You can set up a filter in a sequential steps by **Multi level filtering**. In each level, you can select specific items to “AND” to the previous level. The results of all levels show in views (see the following three figures).



Filter Options

☐ Bus Condition
☐ Primitive
☐ Incomplete Frames
☐ Address Frames
☐ SSP Frames
☐ SMP Frames
☐ STP Frames
☐ SCSI Commands
☐ SMP Commands
☐ Task Management Functions
☐ ATA Commands
☐ SCSI Command Status
☐ Source SAS Address
☐ Destination SAS Address
☑ Pair SAS Address
☐ Protocol Error
☐ STP Port
☐ Tag
☐ ATAPI SCSI Command
☐ Miscellaneous

☑ 0x50060560000003C5-->0x500062B000001074
☐ 0x50060560000003C4-->0x500062B000001074
☑ 0x5000C500001047B5-->0x500062B000001074
☐ 0x5000E85000000001-->0xE9AE8E
☐ 0x5000E85000000001-->0x5000C50000103D91
☐ 0x5000C50000103D91-->0x5000E85000000001
☐ 0x5000C50000103D91-->0x500062B000001074
☐ 0x500062B000001074-->0x50060560000003C5
☐ 0x500062B000001074-->0x5000C500001047B5
☐ 0x500062B000001074-->0x5000C50000103D91
☐ 0x500062B000001074-->0x50060560000003C4

Filter Type: ● Hide ○ Show

☐ Filter Idle

Ports: ☑ I1 ☑ I2 ☑ I3 ☑ I4 ☑ T1 ☑ T2 ☑ T3 ☑ T4

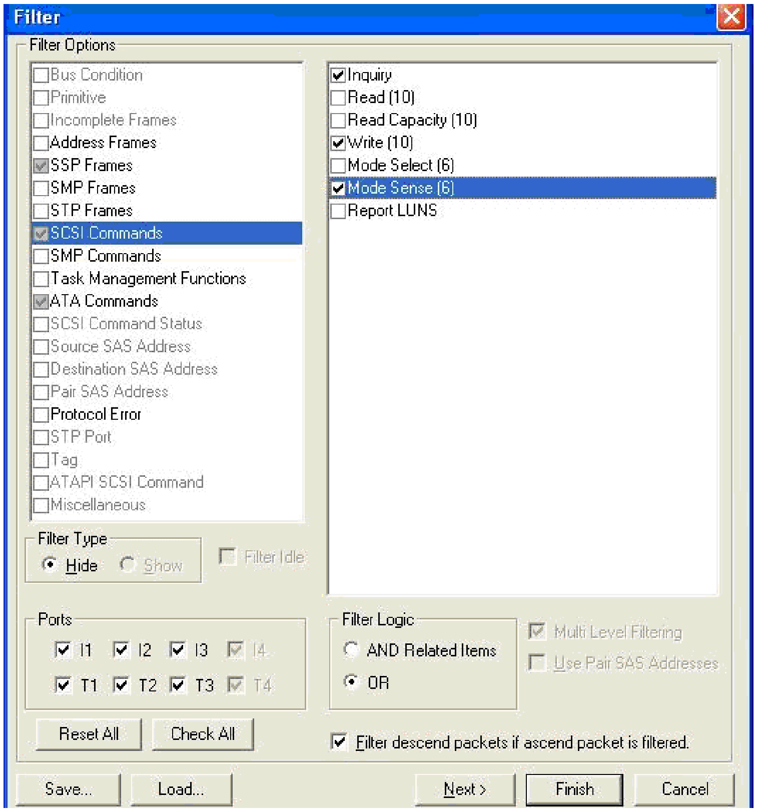
Filter Logic: ○ AND Related Items ● OR

☑ Multi Level Filtering

☑ Use Pair SAS Addresses

☑ Filter descend packets if ascend packet is filtered.

Figure 3.123: First Level of Multilevel Filtering


Filter
Filter Options
Filter Type
Ports
Filter Logic
Reset All
Check All
Save...
Load...
Next >
Finish
Cancel

- ☐ Bus Condition
- ☐ Primitive
- ☐ Incomplete Frames
- ☐ Address Frames
- ☑ SSP Frames
- ☐ SMP Frames
- ☐ STP Frames
- ☑ SCSI Commands
- ☐ SMP Commands
- ☐ Task Management Functions
- ☑ ATA Commands
- ☐ SCSI Command Status
- ☐ Source SAS Address
- ☐ Destination SAS Address
- ☐ Pair SAS Address
- ☐ Protocol Error
- ☐ STP Port
- ☐ Tag
- ☐ ATAPI SCSI Command
- ☐ Miscellaneous

- ☑ Inquiry
- ☐ Read (10)
- ☐ Read Capacity (10)
- ☑ Write (10)
- ☐ Mode Select (6)
- ☑ Mode Sense (6)
- ☐ Report LUNS

Filter Type: ● Hide ○ Show ☐ Filter Idle

Ports: ☑ I1 ☑ I2 ☑ I3 ☑ I4 ☑ T1 ☑ T2 ☑ T3 ☑ T4

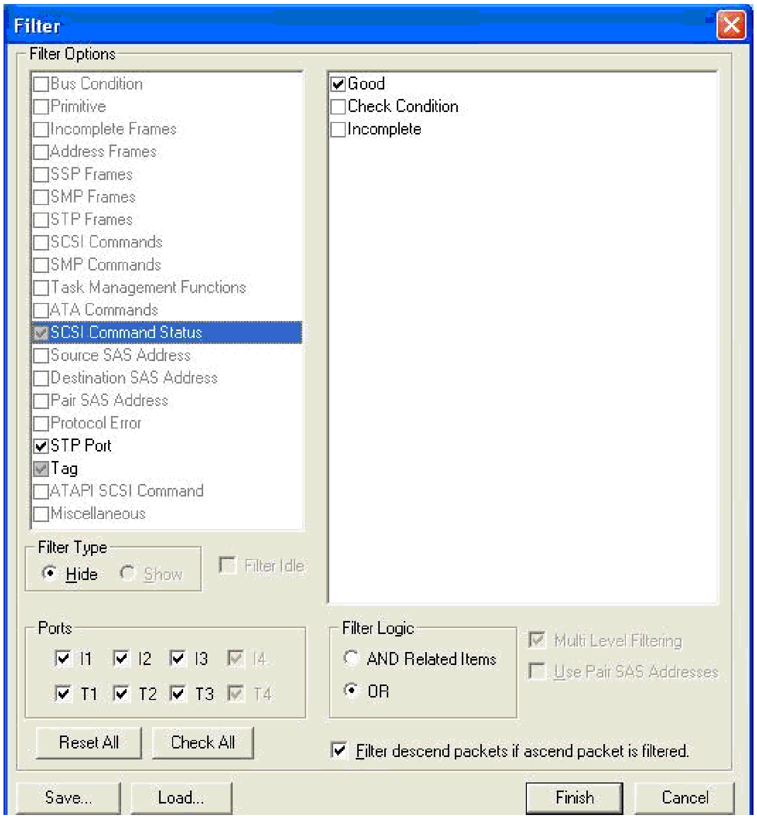
Filter Logic: ○ AND Related Items ● OR

☑ Multi Level Filtering

☐ Use Pair SAS Addresses

☑ Filter descend packets if ascend packet is filtered.

Figure 3.124: Second Level of Multilevel Filtering


Filter
Filter Options
Filter Type
Ports
Filter Logic
Reset All
Check All
Save...
Load...
Finish
Cancel

- ☐ Bus Condition
- ☐ Primitive
- ☐ Incomplete Frames
- ☐ Address Frames
- ☐ SSP Frames
- ☐ SMP Frames
- ☐ STP Frames
- ☐ SCSI Commands
- ☐ SMP Commands
- ☐ Task Management Functions
- ☐ ATA Commands
- ☑ SCSI Command Status
- ☐ Source SAS Address
- ☐ Destination SAS Address
- ☐ Pair SAS Address
- ☐ Protocol Error
- ☑ STP Port
- ☑ Tag
- ☐ ATAPI SCSI Command
- ☐ Miscellaneous

- ☑ Good
- ☐ Check Condition
- ☐ Incomplete

Filter Type: ● Hide ○ Show ☐ Filter Idle

Ports: ☑ I1 ☑ I2 ☑ I3 ☑ I4 ☑ T1 ☑ T2 ☑ T3 ☑ T4

Filter Logic: ○ AND Related Items ● OR

☑ Multi Level Filtering

☐ Use Pair SAS Addresses

☑ Filter descend packets if ascend packet is filtered.

Figure 3.125: Third Level of Multilevel Filtering

Filter Descend Packets if Ascent Packet is Filtered

If you check the **Filter descend packets if ascend packet is filtered** checkbox, the application will only filter onward from the highlighted trace selection bar.

If you uncheck this option, the software only filters the filtered packet. For example, if this option is checked and any SCSI command is selected, all transport and link packets of this command are filtered. If you unchecked this option, only selected SCSI commands are filtered.

3.8.4 Selectable Filter Options for SAS

The SAS Filter Options are:

- Command Data Pattern
- Bus Condition
- Primitive
- Incomplete Frames
- Address Frames
- SSP Frames
- SMP Frames
- STP Frames
- SCSI Commands
- SMP Commands
- Task Management Functions
- ATA Commands
- SCSI Command Status (see Filter Check Condition on page 213)
- Source SAS Address
- Destination SAS Address
- Pair SAS Address
- Protocol Error
- STP Port
- Tag (see Filter by Tag Number on page 214)
- ATAPI SCSI Command
- Device Sleep
- Miscellaneous (see Filter Miscellaneous on page 214)
- Training Sequence

Command Data Pattern

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured Command Data Patterns in the Trace Viewer.

Bus Condition

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured Bus Conditions in the Trace Viewer.

Incomplete Frames

When selected, depending on the Filter Type, the Hide/Show selection shows or hides Incomplete Frames in the Trace Viewer.

ATA Command

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured ATA commands in the Trace Viewer.

Protocol Error

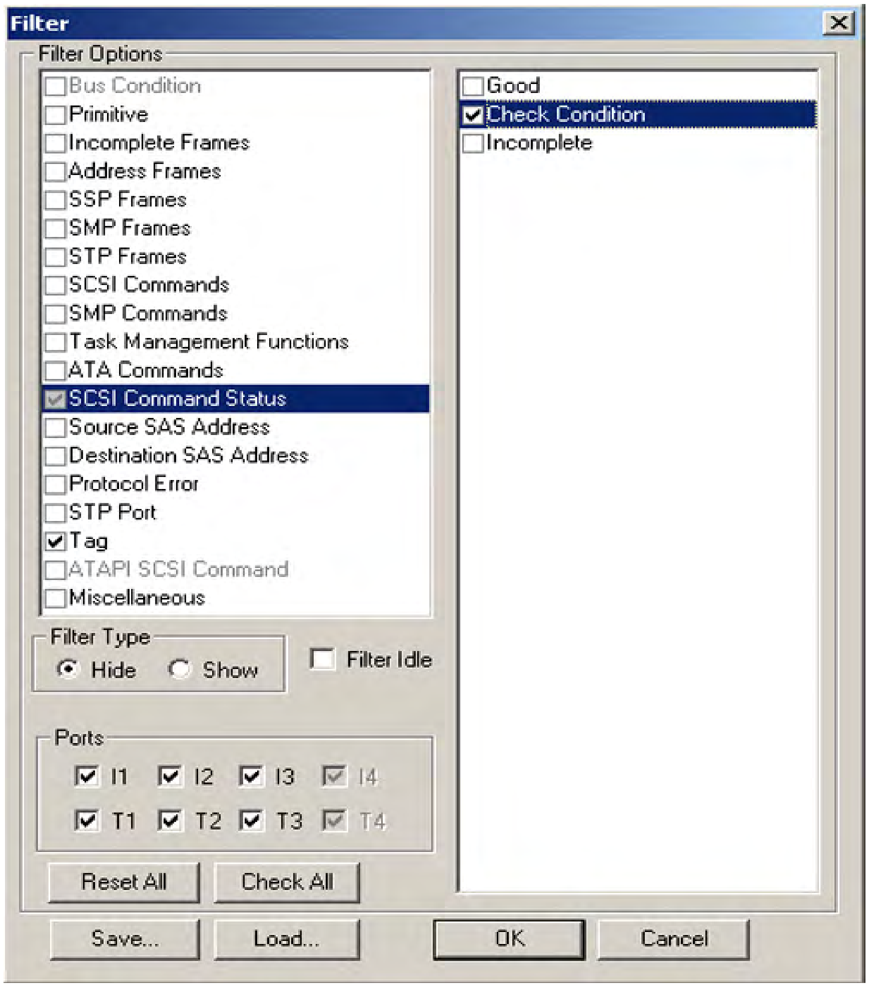
When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured packets with the specified Protocol Errors in the Trace Viewer.

ATAPI SCSI Command

When selected, depending on the Filter Type, the Show/Hide selection shows or hides ATAPI SCSI commands.

Filter Check Condition

Checking the **SCSI Command Status** check box enables Check Condition for filtering (see Figure 3.126 on page 213).



Filter

Filter Options

☐ Bus Condition
☐ Primitive
☐ Incomplete Frames
☐ Address Frames
☐ SSP Frames
☐ SMP Frames
☐ STP Frames
☐ SCSI Commands
☐ SMP Commands
☐ Task Management Functions
☐ ATA Commands
☑ SCSI Command Status
☐ Source SAS Address
☐ Destination SAS Address
☐ Protocol Error
☐ STP Port
☑ Tag
☐ ATAPI SCSI Command
☐ Miscellaneous

☐ Good
☑ Check Condition
☐ Incomplete

Filter Type: ● Hide ○ Show

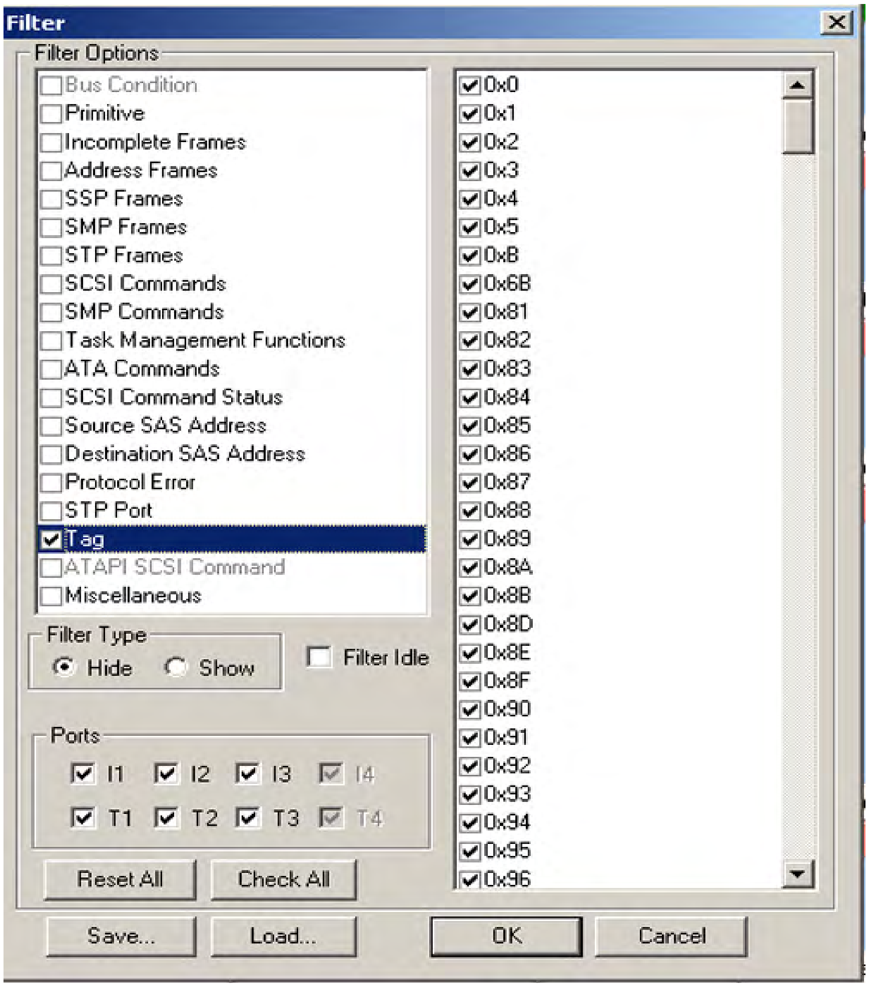
☐ Filter Idle

Ports: ☑ I1 ☑ I2 ☑ I3 ☑ I4 ☑ T1 ☑ T2 ☑ T3 ☑ T4

Figure 3.126: SAS: Filter Check Condition

Filter by Tag Number

Checking the **Tag** check box displays tags available for filtering. Check the corresponding check boxes for tags to filter.



☐ Bus Condition
☐ Primitive
☐ Incomplete Frames
☐ Address Frames
☐ SSP Frames
☐ SMP Frames
☐ STP Frames
☐ SCSI Commands
☐ SMP Commands
☐ Task Management Functions
☐ ATA Commands
☐ SCSI Command Status
☐ Source SAS Address
☐ Destination SAS Address
☐ Protocol Error
☐ STP Port
☑ Tag
☐ ATAPI SCSI Command
☐ Miscellaneous

Filter Type: ● Hide ○ Show

☐ Filter Idle

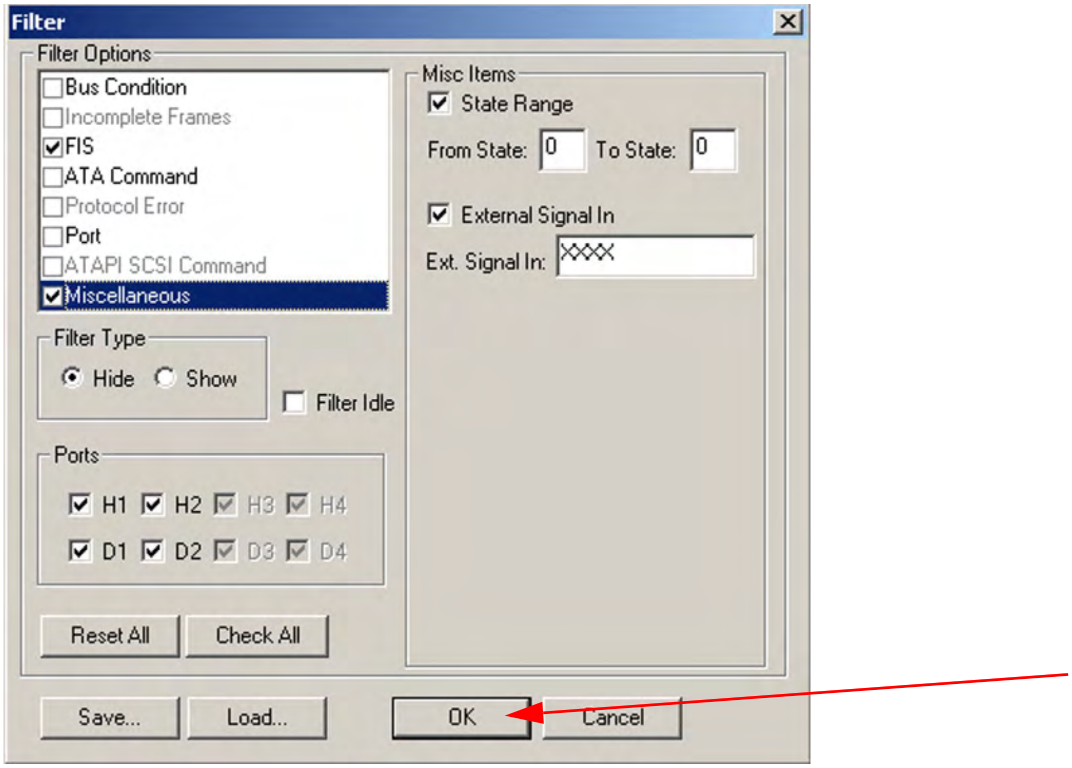
Ports: ☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4

☑ 0x0
☑ 0x1
☑ 0x2
☑ 0x3
☑ 0x4
☑ 0x5
☑ 0xB
☑ 0x6B
☑ 0x81
☑ 0x82
☑ 0x83
☑ 0x84
☑ 0x85
☑ 0x86
☑ 0x87
☑ 0x88
☑ 0x89
☑ 0x8A
☑ 0x8B
☑ 0x8D
☑ 0x8E
☑ 0x8F
☑ 0x90
☑ 0x91
☑ 0x92
☑ 0x93
☑ 0x94
☑ 0x95
☑ 0x96

Figure 3.127: SAS: Filter by Tag Number

Filter Miscellaneous

When you choose **Miscellaneous**, an additional dialog displays, allowing you to specify the filtering of State Range and/or External Signal In (see Figure 3.128 on page 215).



Filter

Filter Options

☐ Bus Condition
☐ Incomplete Frames
☑ FIS
☐ ATA Command
☐ Protocol Error
☐ Port
☐ ATAPI SCSI Command
☑ Miscellaneous

Filter Type: ● Hide ○ Show

☐ Filter Idle

Ports: ☑ H1 ☑ H2 ☑ H3 ☑ H4 ☑ D1 ☑ D2 ☑ D3 ☑ D4

Misc Items

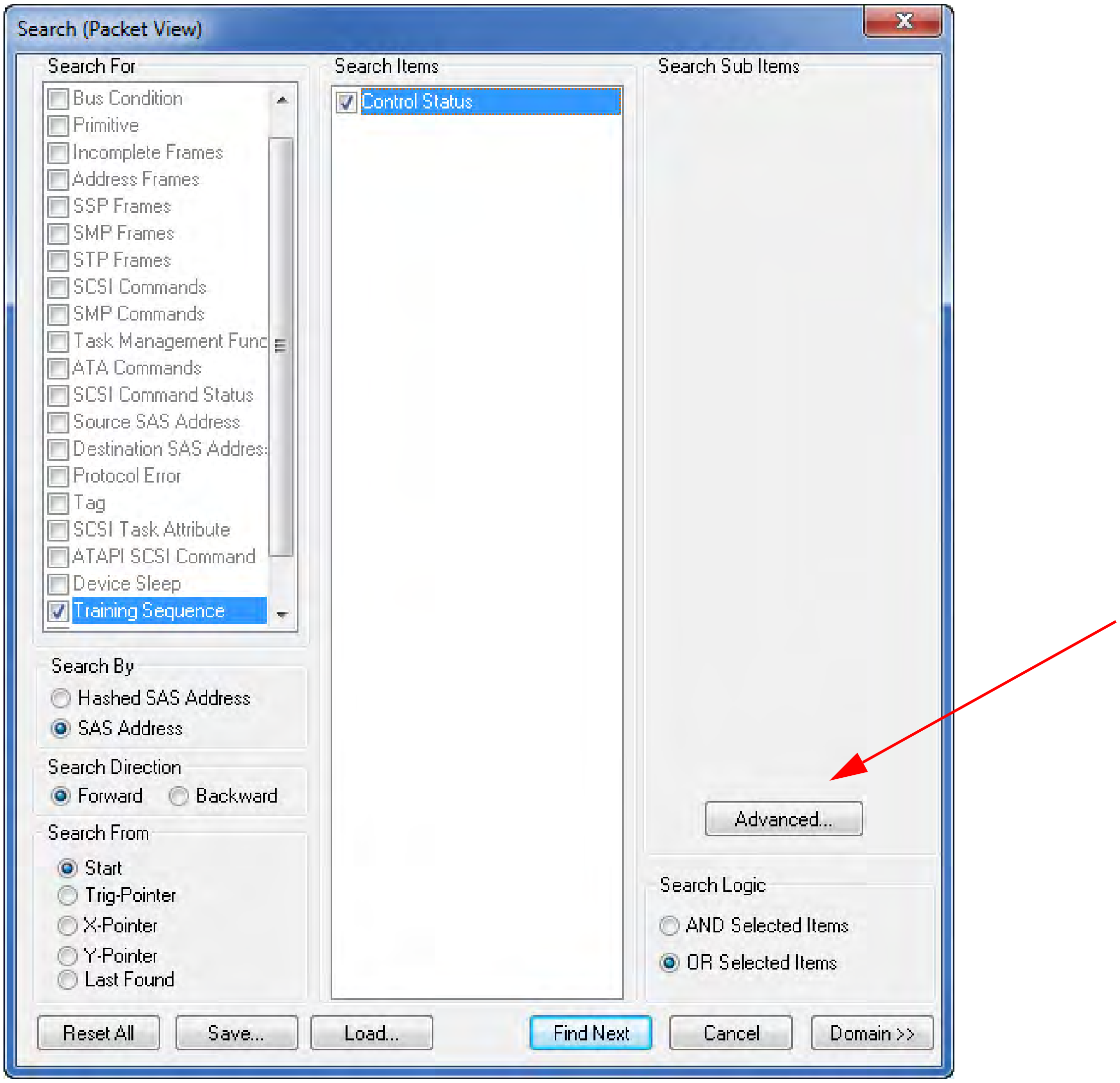
☑ State Range
From State: 0 To State: 0

☑ External Signal In
Ext. Signal In: XXXX

Figure 3.128: Filter State and/or Device Sleep

Filter TTIU Events

When you choose **Training Sequence**, an additional dialog displays, allowing you to filter Training Sequence TTIU fields in a Training Sequence trace (see Figure 3.129 on page 216). Select T**raining Sequence > Control Status** and click **Advanced** to display the Control Status dialog (see Figure 3.130 on page 216). Select the Fields and the Values for them from the drop-down list.


Search (Packet View)
Search For
Search Items
Search Sub Items
Advanced...
Reset All
Save...
Load...
Find Next
Cancel
Domain >>

Search For:
- ☐ Bus Condition
- ☐ Primitive
- ☐ Incomplete Frames
- ☐ Address Frames
- ☐ SSP Frames
- ☐ SMP Frames
- ☐ STP Frames
- ☐ SCSI Commands
- ☐ SMP Commands
- ☐ Task Management Func
- ☐ ATA Commands
- ☐ SCSI Command Status
- ☐ Source SAS Address
- ☐ Destination SAS Addres
- ☐ Protocol Error
- ☐ Tag
- ☐ SCSI Task Attribute
- ☐ ATAPI SCSI Command
- ☐ Device Sleep
- ☑ Training Sequence

Search Items:
- ☑ Control Status

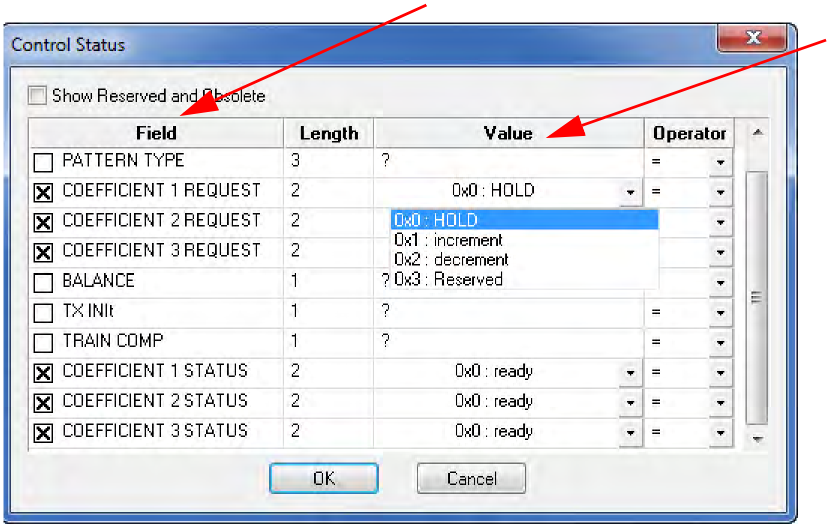
Search By: ○ Hashed SAS Address ● SAS Address

Search Direction: ● Forward ○ Backward

Search From: ● Start ○ Trig-Pointer ○ X-Pointer ○ Y-Pointer ○ Last Found

Search Logic: ○ AND Selected Items ● OR Selected Items

Figure 3.129: Filter Training Sequence TTIU Fields


Control Status
OK
Cancel

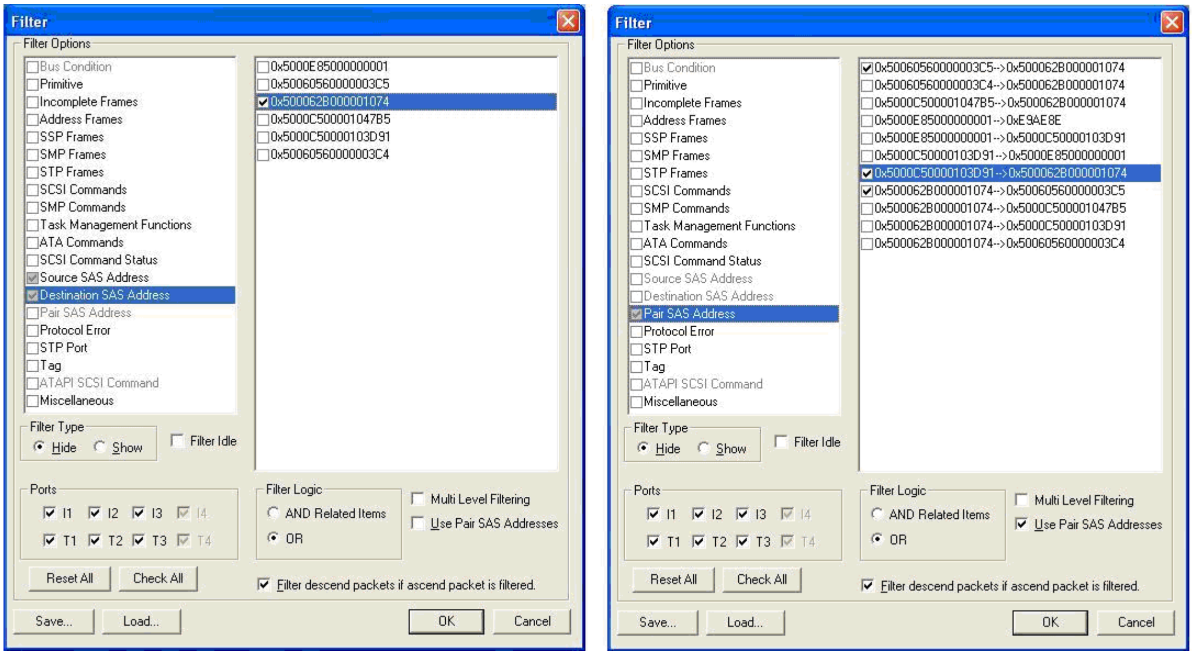
☐ Show Reserved and Obsolete

	Field	Length	Value	Operator
☐	PATTERN TYPE	3	?	=
☒	COEFFICIENT 1 REQUEST	2	0x0 : HOLD	=
☒	COEFFICIENT 2 REQUEST	2	0x0 : HOLD 0x1 : increment 0x2 : decrement 0x3 : Reserved	
☒	COEFFICIENT 3 REQUEST	2		
☐	BALANCE	1	?	
☐	TX INIt	1	?	=
☐	TRAIN COMP	1	?	=
☒	COEFFICIENT 1 STATUS	2	0x0 : ready	=
☒	COEFFICIENT 2 STATUS	2	0x0 : ready	=
☒	COEFFICIENT 3 STATUS	2	0x0 : ready	=

Figure 3.130: Select Field and Values to Filter

Use Pair SAS Addresses

You can use all available pair SAS addresses (Source -> Destination) instead of using SAS source and destination addresses. To enable the pair SAS address filter option, check **Use Pair SAS Addresses** check box in the Filter dialog (see Figure 3.131 on page 217).



Filter Options:
☐ Bus Condition
☐ Primitive
☐ Incomplete Frames
☐ Address Frames
☐ SSP Frames
☐ SMP Frames
☐ STP Frames
☐ SCSI Commands
☐ SMP Commands
☐ Task Management Functions
☐ ATA Commands
☐ SCSI Command Status
☑ Source SAS Address
☑ Destination SAS Address
☐ Pair SAS Address
☐ Protocol Error
☐ STP Port
☐ Tag
☐ ATAPI SCSI Command
☐ Miscellaneous

☐ 0x5000E85000000001
☐ 0x50060560000003C5
☑ 0x500062B000001074
☐ 0x5000C500001047B5
☐ 0x5000C50000103D91
☐ 0x50060560000003C4

Filter Type: ● Hide ○ Show ☐ Filter Idle
Ports: ☑ I1 ☑ I2 ☑ I3 ☑ I4 ☑ T1 ☑ T2 ☑ T3 ☑ T4
Filter Logic: ○ AND Related Items ● OR
☐ Multi Level Filtering
☐ Use Pair SAS Addresses
☑ Filter descend packets if ascend packet is filtered.

Filter Options:
☐ Bus Condition
☐ Primitive
☐ Incomplete Frames
☐ Address Frames
☐ SSP Frames
☐ SMP Frames
☐ STP Frames
☐ SCSI Commands
☐ SMP Commands
☐ Task Management Functions
☐ ATA Commands
☐ SCSI Command Status
☐ Source SAS Address
☐ Destination SAS Address
☑ Pair SAS Address
☐ Protocol Error
☐ STP Port
☐ Tag
☐ ATAPI SCSI Command
☐ Miscellaneous

☑ 0x50060560000003C5-->0x500062B000001074
☐ 0x50060560000003C4-->0x500062B000001074
☐ 0x5000C500001047B5-->0x500062B000001074
☐ 0x5000E85000000001-->0xE9AE8E
☐ 0x5000E85000000001-->0x5000C50000103D91
☐ 0x5000C50000103D91-->0x5000E85000000001
☑ 0x5000C50000103D91-->0x500062B000001074
☑ 0x500062B000001074-->0x50060560000003C5
☐ 0x500062B000001074-->0x5000C500001047B5
☐ 0x500062B000001074-->0x5000C50000103D91
☐ 0x500062B000001074-->0x50060560000003C4

Filter Type: ● Hide ○ Show ☐ Filter Idle
Ports: ☑ I1 ☑ I2 ☑ I3 ☑ I4 ☑ T1 ☑ T2 ☑ T3 ☑ T4
Filter Logic: ○ AND Related Items ● OR
☐ Multi Level Filtering
☑ Use Pair SAS Addresses
☑ Filter descend packets if ascend packet is filtered.

Figure 3.131: SAS: SAS Address Filtering before and after Using Pair SAS Addresses

Note: If you enable pair SAS addresses, the source/destination SAS addresses options are disabled and filtering on them is ignored at filtering time. If you disable pair SAS addresses, the pair SAS address option is disabled and filtering on it is ignored at filtering time.

Training Sequence

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured Training Sequences in the Trace Viewer.

3.8.5 Selectable Filter Options for SATA

The SATA filter options are:

- Bus Condition
- Incomplete Frames
- FIS
- ATA Command
- Protocol Error
- Port
- ATAPI SCSI Command
- Device Sleep
- Miscellaneous

Bus Condition

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured Bus Conditions in the Trace Viewer.

Incomplete Frames

When selected, depending on the Filter Type, the Hide/Show selection shows or hides Incomplete Frames in the Trace Viewer.

FIS

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured FIS items in the Trace Viewer.

ATA Command

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured ATA commands in the Trace Viewer.

Protocol Error

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured packets with the specified Protocol Errors in the Trace Viewer.

Port

When selected, depending on the Filter Type, the Show/Hide selection shows or hides packet traffic for the selected port.

ATAPI SCSI Command

When selected, depending on the Filter Type, the Show/Hide selection shows or hides ATAPI SCSI commands.

Miscellaneous

When you choose Miscellaneous, an additional dialog displays, allowing you to specify the filtering of State Range and/or External Signal In (see Filter Miscellaneous on page 214).

3.8.6 Enable Filter

Select **Filtering > Enable Filtering** or click the **Filter Enable** button on the display menu bar to toggle between Filtered and Unfiltered display.

3.8.7 Filter Idle

Depending on the Filter Type (Hide/Show), Idle packets in the Sample Viewer are shown or hidden.

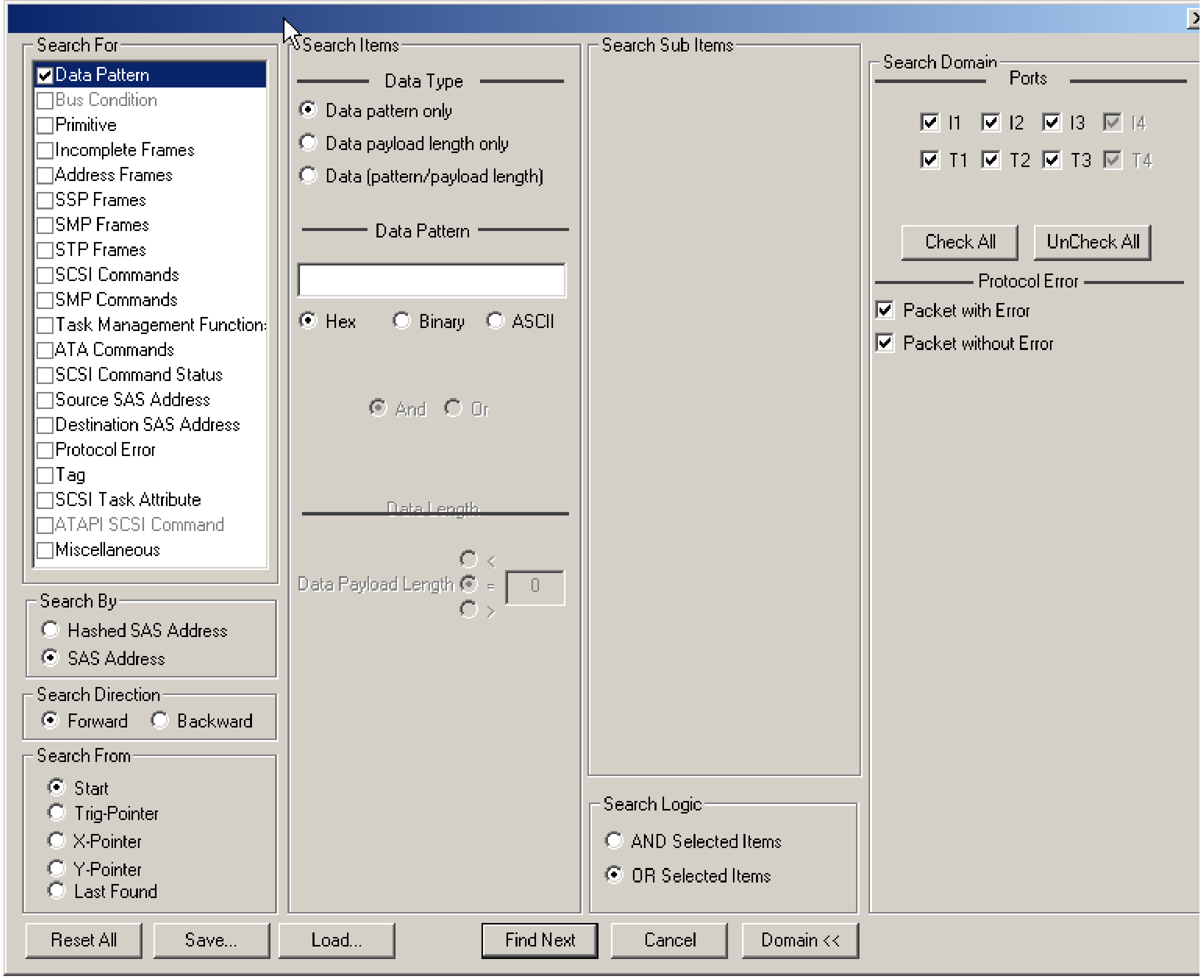
You can quickly filter idles by clicking the **Filter Idle** button. This button toggles between Show and Hide items.

3.8.8 Search

The Search menu and toolbar options permit you to examine any data capture file to quickly locate the packet or data pattern.

To perform an initial search, select **Navigation > Search** or click the **Search** button to open the Search setup dialog (see Figure 3.132 on page 219).

Note: Only items captured in the sample file are enabled for search.



Search For
☑ Data Pattern
☐ Bus Condition
☐ Primitive
☐ Incomplete Frames
☐ Address Frames
☐ SSP Frames
☐ SMP Frames
☐ STP Frames
☐ SCSI Commands
☐ SMP Commands
☐ Task Management Function
☐ ATA Commands
☐ SCSI Command Status
☐ Source SAS Address
☐ Destination SAS Address
☐ Protocol Error
☐ Tag
☐ SCSI Task Attribute
☐ ATAPI SCSI Command
☐ Miscellaneous

Search By
○ Hashed SAS Address
● SAS Address

Search Direction
● Forward ○ Backward

Search From
● Start
○ Trig-Pointer
○ X-Pointer
○ Y-Pointer
○ Last Found

Search Items

Data Type
● Data pattern only
○ Data payload length only
○ Data (pattern/payload length)

Data Pattern
● Hex ○ Binary ○ ASCII
● And ○ Or

Data Length
Data Payload Length ○ < ● = ○ > 0

Search Sub Items

Search Logic
○ AND Selected Items
● OR Selected Items

Search Domain
Ports
☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4

Check All UnCheck All

Protocol Error
☑ Packet with Error
☑ Packet without Error

Figure 3.132: Search Data Pattern

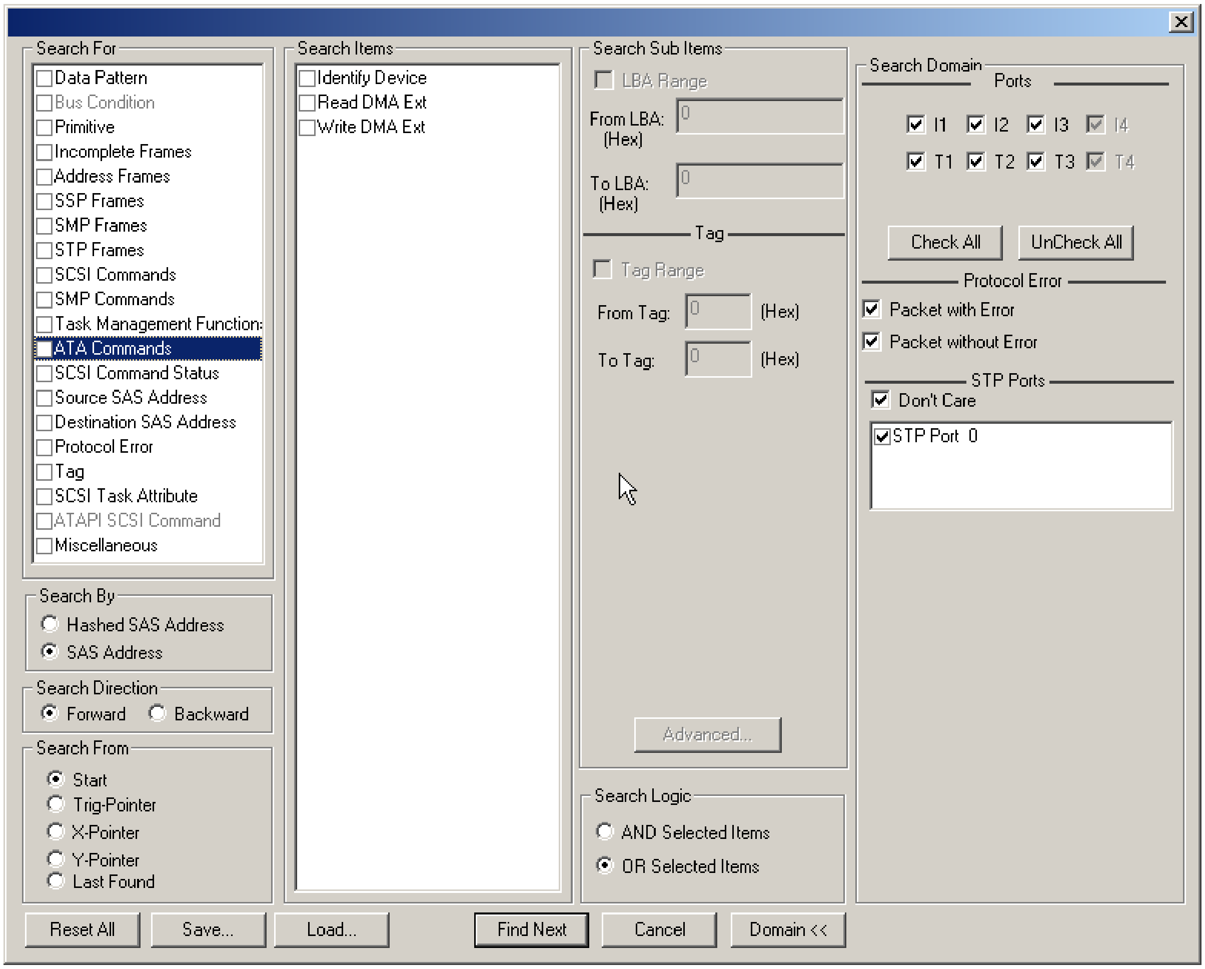

Search For
☐ Data Pattern
☐ Bus Condition
☐ Primitive
☐ Incomplete Frames
☐ Address Frames
☐ SSP Frames
☐ SMP Frames
☐ STP Frames
☐ SCSI Commands
☐ SMP Commands
☐ Task Management Function:
☐ ATA Commands
☐ SCSI Command Status
☐ Source SAS Address
☐ Destination SAS Address
☐ Protocol Error
☐ Tag
☐ SCSI Task Attribute
☐ ATAPI SCSI Command
☐ Miscellaneous
Search Items
☐ Identify Device
☐ Read DMA Ext
☐ Write DMA Ext
Search Sub Items
☐ LBA Range
From LBA: (Hex) 0
To LBA: (Hex) 0
Tag
☐ Tag Range
From Tag: 0 (Hex)
To Tag: 0 (Hex)
Advanced...
Search Domain
Ports
☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4
Check All
UnCheck All
Protocol Error
☑ Packet with Error
☑ Packet without Error
STP Ports
☑ Don't Care
☑ STP Port 0
Search By
○ Hashed SAS Address
● SAS Address
Search Direction
● Forward ○ Backward
Search From
● Start
○ Trig-Pointer
○ X-Pointer
○ Y-Pointer
○ Last Found
Search Logic
○ AND Selected Items
● OR Selected Items
Reset All
Save...
Load...
Find Next
Cancel
Domain <<

Figure 3.133: Search Parameter Definition Dialog

You can continue to search the output file using **Next Search (F3)** or **Previous Search (F4)** for the same pattern, until you redefine the data capture search parameters.

Save Search Setup

After you have set up a Search configuration, you can save it as a SAS Search configuration file (***.ssh**) or a SATA Search configuration file (***.tsh**) by clicking **Save**. You can then use it on a different capture by clicking **Load** in the Search dialog.

Search By

Choose **Hashed SAS Address** to search on hash address, or choose **SAS Address** to search for address.

Search Direction

Choose either **Forward** or **Backward** direction in which to perform the search.

Search From

Choose a starting point to begin or continue a search: Start of the sample file, Trigger Pointer, X Pointer, Y Pointer, or Last Found.

Search Logic

Search looks for entities in a trace. When you choose SCSI command **AND** SSP frame, for instance, search will return all entities in the trace that are SCSI commands, **AND** are SSP frames. Any SCSI commands that are **NOT** SSP frames, will not, in this case, be returned.

If you choose **OR**, search will return all entities that are SCSI commands as well as all SSP frames.

The AND operator is only applicable for certain cases, such as:

- ❑ A SCSI command AND a Tag.
- ❑ A SCSI command AND a source/destination address.

For example, when you choose a SCSI command AND a tag = 0x1, you will get all entities on a trace that are SCSI commands that have tags equal to "0x1" in that SCSI command.

As a general rule, it is not possible to apply AND on two packet types (frames, commands, primitives, training sequences or bus conditions). It only works when you apply AND on one packet type with other items such as source/Destination Addresses, TAG, Task attribute.

Search For

Choose a category to search in the **Search For** window. Each of the search categories offers additional choices in the **Search Items window** to refine the search. Check items for the selected category.

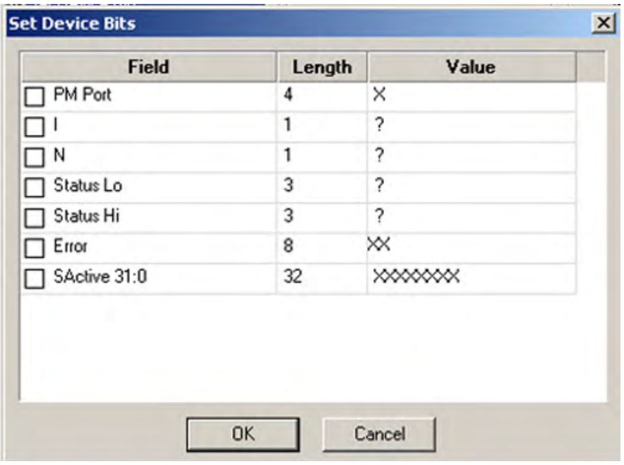
Data Pattern

Search for Data Pattern allows you to search for a specific Data Type, Pattern, and Length (see Figure 3.132 on page 219).

- ❑ Data Pattern Only
- ❑ Data Payload Length Only
- ❑ Data Pattern and Data Payload Length

Advanced options

Some of the Search For categories offer advanced options for search. To set these options, highlight the search item in a category and click the **Advanced** button to open the Advanced options dialog.



Field	Length	Value
☐ PM Port	4	X
☐ I	1	?
☐ N	1	?
☐ Status Lo	3	?
☐ Status Hi	3	?
☐ Error	8	XX
☐ SActive 31:0	32	XXXXXXXX

Figure 3.134: Advanced Options Dialog Example: Set Device Bits

Set the options and click **OK.**

Search Domain

Click the **Domain** button and choose a search domain from all ports or a specific port.

Protocol Error

You can refine the search to locate packets with an error or without an error.

Note: When searching for Protocol Errors in Column View, you cannot search for a specific Protocol Error type. Search returns any protocol error.

Search Sub Items

When searching SCSI Command Status, you can refine the search by selecting from a list of Sub Items.

Note: Some of the search categories allow you to refine the search by specifying specific SAS addresses and STP ports to search.

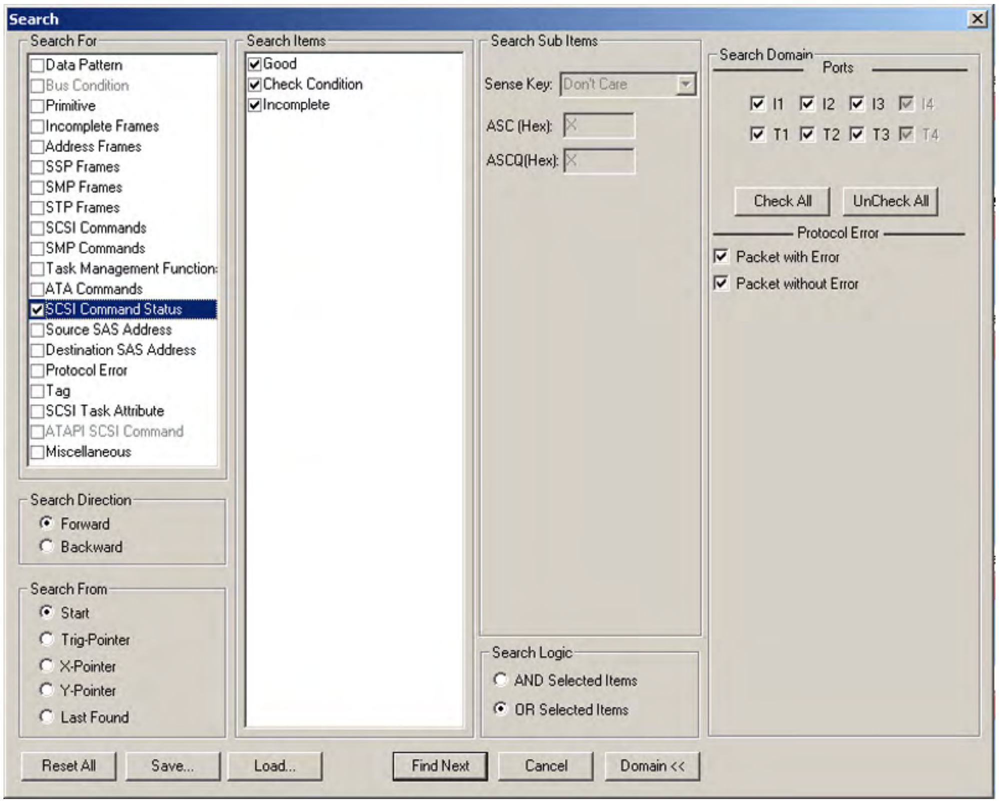

Search
Search For
☐ Data Pattern
☐ Bus Condition
☐ Primitive
☐ Incomplete Frames
☐ Address Frames
☐ SSP Frames
☐ SMP Frames
☐ STP Frames
☐ SCSI Commands
☐ SMP Commands
☐ Task Management Function
☐ ATA Commands
☑ SCSI Command Status
☐ Source SAS Address
☐ Destination SAS Address
☐ Protocol Error
☐ Tag
☐ SCSI Task Attribute
☐ ATAPI SCSI Command
☐ Miscellaneous
Search Direction
● Forward
○ Backward
Search From
● Start
○ Trig-Pointer
○ X-Pointer
○ Y-Pointer
○ Last Found
Search Items
☑ Good
☑ Check Condition
☑ Incomplete
Search Sub Items
Sense Key: Don't Care
ASC (Hex): X
ASCQ(Hex): X
Search Logic
○ AND Selected Items
● OR Selected Items
Search Domain
Ports
☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4
Check All
UnCheck All
Protocol Error
☑ Packet with Error
☑ Packet without Error
Reset All
Save...
Load...
Find Next
Cancel
Domain <<

Figure 3.135: Search Sub Items

When you check the **SCSI Command Status,** the **Check Condition** item appears in the Search Items Window, if a check condition has occurred. Clicking this enables **Search Sub Items,** allowing you to refine the search by specifying **Sense Key, ASC,** and **ASCQ.**

Search by Tag Number

To search by Tag Number, check the **Tags** box in the Search For window and then check the Tag(s) for which to search in the Search Items window.

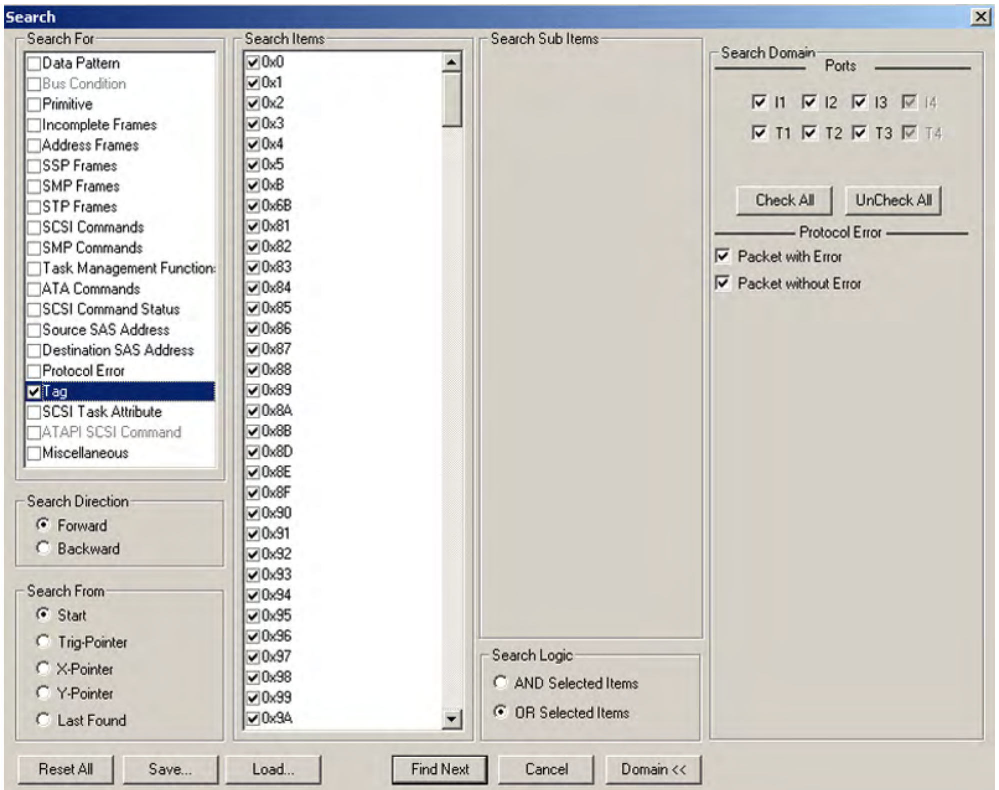

Search
Search For
☐ Data Pattern
☐ Bus Condition
☐ Primitive
☐ Incomplete Frames
☐ Address Frames
☐ SSP Frames
☐ SMP Frames
☐ STP Frames
☐ SCSI Commands
☐ SMP Commands
☐ Task Management Function
☐ ATA Commands
☐ SCSI Command Status
☐ Source SAS Address
☐ Destination SAS Address
☐ Protocol Error
☑ Tag
☐ SCSI Task Attribute
☐ ATAPI SCSI Command
☐ Miscellaneous
Search Items
☑ 0x0
☑ 0x1
☑ 0x2
☑ 0x3
☑ 0x4
☑ 0x5
☑ 0xB
☑ 0x6B
☑ 0x81
☑ 0x82
☑ 0x83
☑ 0x84
☑ 0x85
☑ 0x86
☑ 0x87
☑ 0x88
☑ 0x89
☑ 0x8A
☑ 0x8B
☑ 0x8D
☑ 0x8E
☑ 0x8F
☑ 0x90
☑ 0x91
☑ 0x92
☑ 0x93
☑ 0x94
☑ 0x95
☑ 0x96
☑ 0x97
☑ 0x98
☑ 0x99
☑ 0x9A
Search Sub Items
Search Domain
Ports
☑ I1 ☑ I2 ☑ I3 ☑ I4
☑ T1 ☑ T2 ☑ T3 ☑ T4
Check All
UnCheck All
Protocol Error
☑ Packet with Error
☑ Packet without Error
Search Direction
● Forward
○ Backward
Search From
● Start
○ Trig-Pointer
○ X-Pointer
○ Y-Pointer
○ Last Found
Search Logic
○ AND Selected Items
● OR Selected Items
Reset All
Save...
Load...
Find Next
Cancel
Domain <<

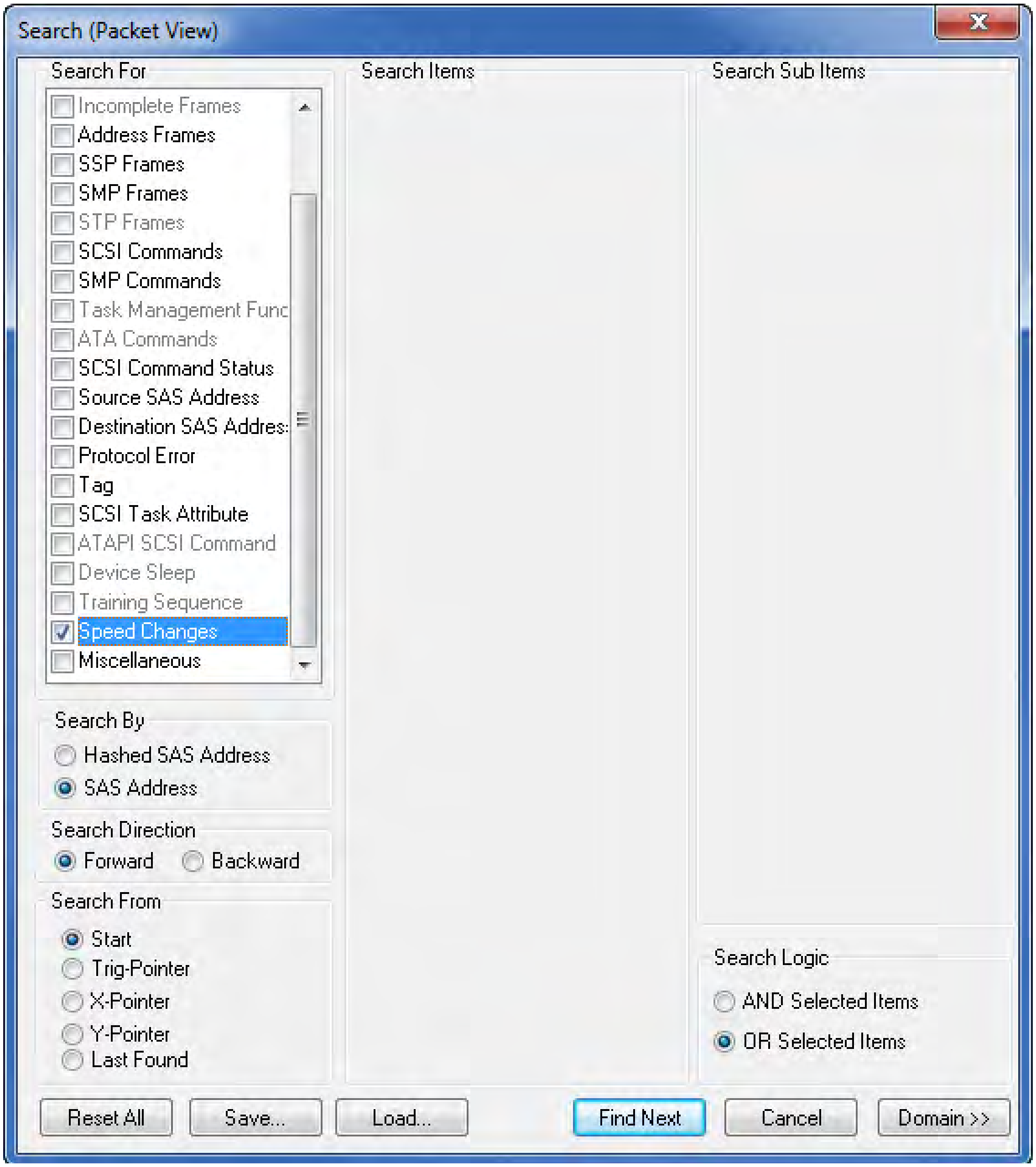
Figure 3.136: Search by Tag Number

Search TTIU Events

See Filter TTIU Events on page 215 for details.

Search by Speed

To search by **Speed**, check the **Speed** box in the Search For window to look for points where speed changes occurred in the trace.



Search (Packet View)

Search For
☐ Incomplete Frames
☐ Address Frames
☐ SSP Frames
☐ SMP Frames
☐ STP Frames
☐ SCSI Commands
☐ SMP Commands
☐ Task Management Func
☐ ATA Commands
☐ SCSI Command Status
☐ Source SAS Address
☐ Destination SAS Addres
☐ Protocol Error
☐ Tag
☐ SCSI Task Attribute
☐ ATAPI SCSI Command
☐ Device Sleep
☐ Training Sequence
☑ Speed Changes
☐ Miscellaneous

Search By
○ Hashed SAS Address
● SAS Address

Search Direction
● Forward ○ Backward

Search From
● Start
○ Trig-Pointer
○ X-Pointer
○ Y-Pointer
○ Last Found

Search Items

Search Sub Items

Search Logic
○ AND Selected Items
● OR Selected Items

Figure 3.137: Search by Speed Changes

3.8.9 Show/Hide Ports

You can **Show/Hide a Single Port** or you can **Show/Hide Multiple Ports**. To do so click on the **Ch Down Arrow.**

Show/Hide Single Port

If Show/Hide Single Port is selected, you can click on one port button at a time to show/ hide the capture for that port. Show/Hide Single Port is time consuming as it shows or hides one port at a time.

Show/Hide Multiple Ports

If Show/Hide Multiple Ports is selected, you can click on multiple ports to show or hide them. This mode is much faster. Click on multiple ports to show or hide them.

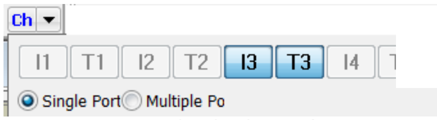


Figure 3.138: SAS: Show/Hide Ports Toolbar

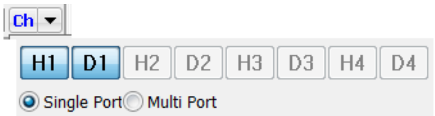
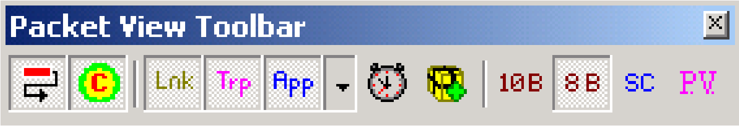


Figure 3.139: SATA: Show/Hide Ports Toolbar

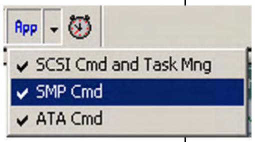
You can also show or hide a port by right-clicking a **Port ID** in Text View or Column View and choosing **Show** or **Hide** (see Figure 3.143 on page 230).

3.9 Packet View Toolbar

The Packet View toolbar allows wrapping, zooming, and configuration.



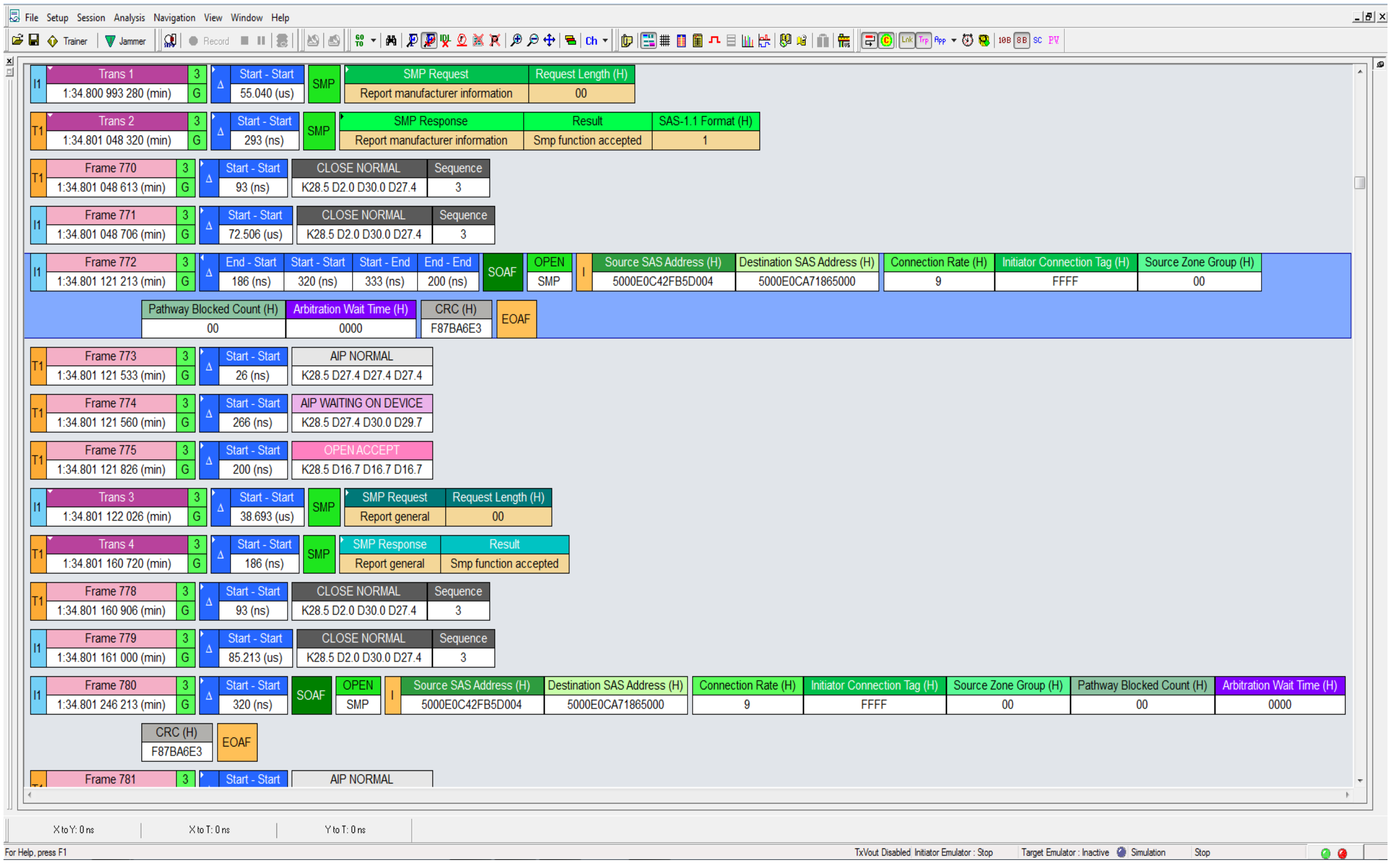
	The **Wrap Packets** button on the Viewer Toolbar wraps the packet data in the display to eliminate the need for horizontal scrolling.
C	Go to CATC Navigation View. Click this button to change the trace display to a CATC Trace™. You can change the colors, fonts, and so on, in the Trace Viewer Configuration (see Trace Viewer Configuration on page 238).

Lnk	The **Show/Hide Link Packet** button displays/hides the Link layer (SAS only).
Trp	The **Show/Hide Transport Packet** button on the Layers Toolbar displays/hides the Transport layer and below (SAS only).
App ▾ 	The **Show/Hide All Commands Packet** button shows/hides the Command layer and all layers below: SCSI Cmd and Task Mng, SMP Cmd, and ATA Cmd (SAS only). Click the down arrow on the **Show/Hide All Commands Packet** button to choose command types to show/hide.
Phy	The **Show/Hide Physical Packet** button toggles the display of physical layer packets (SATA only).
FIS	The **Show/Hide FIS packet** button toggles the display of FIS layer packets. When “OFF”, the FIS layer and its links are hidden (SATA only).
CMD	The **Show/Hide CMD packet** button toggles the display of the CMD packets. When “ON”, only the command layer displays (SATA only).
CQ	The **Show/Hide Command Queue** button displays queued commands. (SATA only.) The CQ button’s hierarchy only applies to **ReadDMAQueued** and **WriteDMAQueued**. The hierarchy for other queued commands is displayed as part of the regular application layer decoding.
⏱	The **Order/Reorder** button toggles the time order of packets. (SATA only)
📦	The **Pack/Unpack Repeated Primitives** toggles packing repeated primitives in one port. (SAS only)
10B	The **10B** button displays the payload data as 10-bit encoded data.
8B	The **8B** button displays the payload as 8-bit scrambled or unscrambled data, depending on the Scrambled setting.
SC	The **SC** button selects scramble/unscramble for the 8-bit payload data.

PV The **PV** button shows/hides the primitive value.

3.9.1 CATC Navigation View

To change the trace display to a CATC Trace™ (see Figure 3.140 on page 228), click the **CATC Navigation** button. You can change the colors, fonts, and so on, in the Trace Viewer Configuration (see Trace Viewer Configuration on page 238).


File Setup Session Analysis Navigation View Window Help
Trainer
Jammer
Record
X to Y: 0 ns
X to T: 0 ns
Y to T: 0 ns
For Help, press F1
TxVout Disabled Initiator Emulator : Stop
Target Emulator : Inactive
Simulation
Stop

I1 Trans 1 3 G 1:34.800 993 280 (min) | Start - Start 55.040 (us) | SMP | SMP Request: Report manufacturer information | Request Length (H): 00

T1 Trans 2 3 G 1:34.801 048 320 (min) | Start - Start 293 (ns) | SMP | SMP Response: Report manufacturer information | Result: Smp function accepted | SAS-1.1 Format (H): 1

T1 Frame 770 3 G 1:34.801 048 613 (min) | Start - Start 93 (ns) | CLOSE NORMAL: K28.5 D2.0 D30.0 D27.4 | Sequence: 3

I1 Frame 771 3 G 1:34.801 048 706 (min) | Start - Start 72.506 (us) | CLOSE NORMAL: K28.5 D2.0 D30.0 D27.4 | Sequence: 3

I1 Frame 772 3 G 1:34.801 121 213 (min) | End - Start 186 (ns) | Start - Start 320 (ns) | Start - End 333 (ns) | End - End 200 (ns) | SOAF | OPEN: SMP | I | Source SAS Address (H): 5000E0C42FB5D004 | Destination SAS Address (H): 5000E0CA71865000 | Connection Rate (H): 9 | Initiator Connection Tag (H): FFFF | Source Zone Group (H): 00 | Pathway Blocked Count (H): 00 | Arbitration Wait Time (H): 0000 | CRC (H): F87BA6E3 | EOAF

T1 Frame 773 3 G 1:34.801 121 533 (min) | Start - Start 26 (ns) | AIP NORMAL: K28.5 D27.4 D27.4 D27.4

T1 Frame 774 3 G 1:34.801 121 560 (min) | Start - Start 266 (ns) | AIP WAITING ON DEVICE: K28.5 D27.4 D30.0 D29.7

T1 Frame 775 3 G 1:34.801 121 826 (min) | Start - Start 200 (ns) | OPEN ACCEPT: K28.5 D16.7 D16.7 D16.7

I1 Trans 3 3 G 1:34.801 122 026 (min) | Start - Start 38.693 (us) | SMP | SMP Request: Report general | Request Length (H): 00

T1 Trans 4 3 G 1:34.801 160 720 (min) | Start - Start 186 (ns) | SMP | SMP Response: Report general | Result: Smp function accepted

T1 Frame 778 3 G 1:34.801 160 906 (min) | Start - Start 93 (ns) | CLOSE NORMAL: K28.5 D2.0 D30.0 D27.4 | Sequence: 3

I1 Frame 779 3 G 1:34.801 161 000 (min) | Start - Start 85.213 (us) | CLOSE NORMAL: K28.5 D2.0 D30.0 D27.4 | Sequence: 3

I1 Frame 780 3 G 1:34.801 246 213 (min) | Start - Start 320 (ns) | SOAF | OPEN: SMP | I | Source SAS Address (H): 5000E0C42FB5D004 | Destination SAS Address (H): 5000E0CA71865000 | Connection Rate (H): 9 | Initiator Connection Tag (H): FFFF | Source Zone Group (H): 00 | Pathway Blocked Count (H): 00 | Arbitration Wait Time (H): 0000 | CRC (H): F87BA6E3 | EOAF

Frame 781 3 | Start - Start | AIP NORMAL

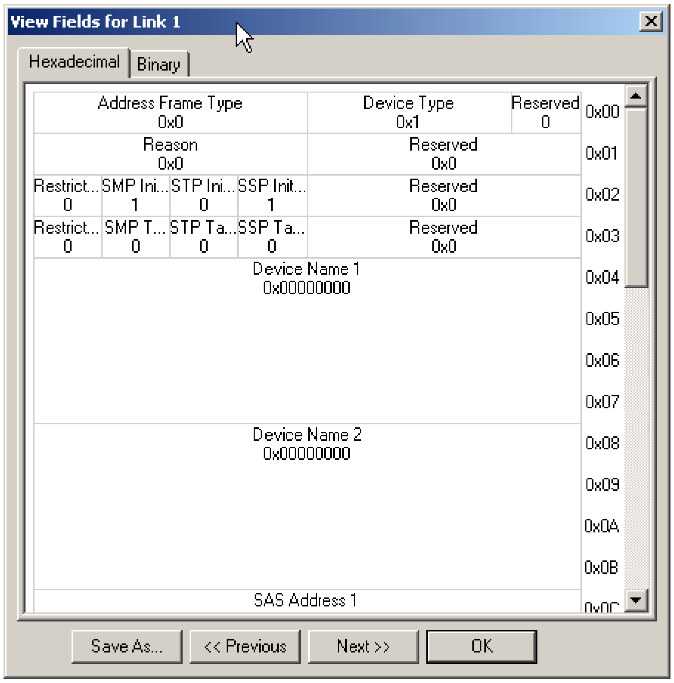
Figure 3.140: CATC Navigation View

3.9.2 Spec View

Spec View shows packet header information.

To obtain the Spec View from the CATC View, left-click to display a popup menu, then select the **View Fields** option (see Figure 3.141 on page 229).

To obtain the Spec View from the Catalyst View, right-click to display a popup menu, then select the **View Fields** option.



Address Frame Type 0x0				Device Type 0x1	Reserved 0	0x00
Reason 0x0				Reserved 0x0		0x01
Restrict... 0	SMP Ini... 1	STP Ini... 0	SSP Init... 1	Reserved 0x0		0x02
Restrict... 0	SMP T... 0	STP Ta... 0	SSP Ta... 0	Reserved 0x0		0x03
Device Name 1 0x00000000						0x04 0x05 0x06 0x07
Device Name 2 0x00000000						0x08 0x09 0x0A 0x0B
SAS Address 1						0x0C

Figure 3.141: Spec View

The tabs allows you to display **Hexadecimal** or **Binary**.

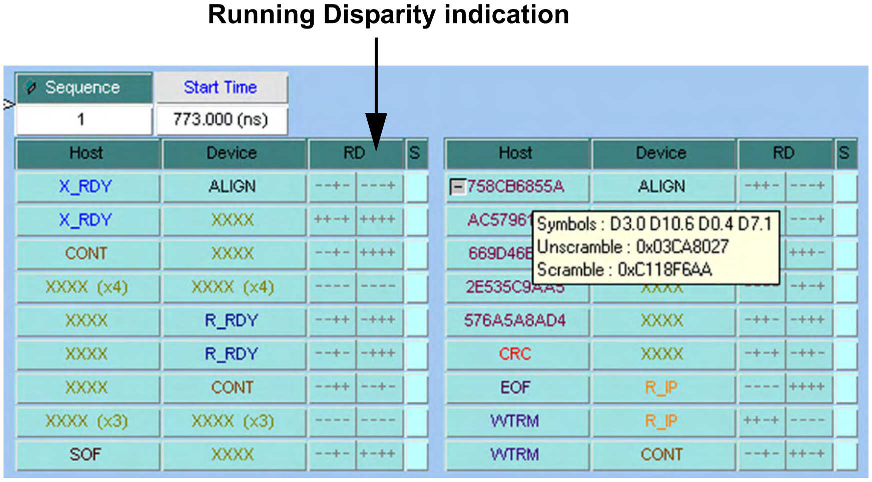
The buttons allow you to go to **Previous** or **Next**.

You can **Save As** a text file.

3.9.3 Decode Icons

The **Decode Toolbar** controls encoding and scrambling features.

To view corresponding Unscrambled and Scrambled payload data values instantaneously, position the mouse pointer over a data field.



Sequence	Start Time
1	773.000 (ns)

Host	Device	RD		S
X_RDY	ALIGN	--+-	---+	
X_RDY	XXXX	++-+	++++	
CONT	XXXX	--+-	++++	
XXXX (x4)	XXXX (x4)	----	----	
XXXX	R_RDY	--++	-+++	
XXXX	R_RDY	--+-	-+++	
XXXX	CONT	--++	--+-	
XXXX (x3)	XXXX (x3)	----	----	
SOF	XXXX	--+-	+-++	

Host	Device	RD		S
758CB6855A	ALIGN	-++-	---+	
AC5796			---+	
669D46B			+++-	
2E535C9AA5	XXXX		-+-+	
576A5A8AD4	XXXX	-++-	-+++	
CRC	XXXX	-+-+	-++-	
EOF	R_IP	----	++++	
WTRM	R_IP	++-+	----	
WTRM	CONT	--+-	++-+	

Symbols : D3.0 D10.6 D0.4 D7.1
Unscramble : 0x03CA8027
Scramble : 0xC118F6AA

Figure 3.142: Payload Data Display

3.9.4 Customize Display

You can customize the display as explained below.

Rename Port

You can rename each port for easy identification. To rename a port, right-click the **port ID** in Text View or Column View.

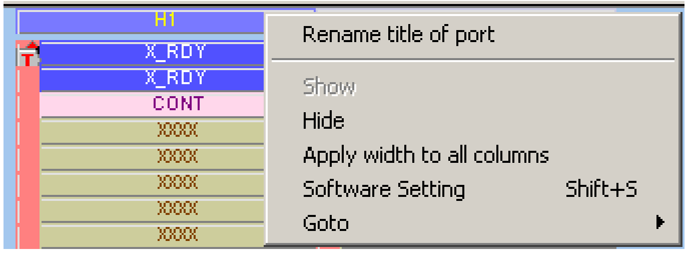
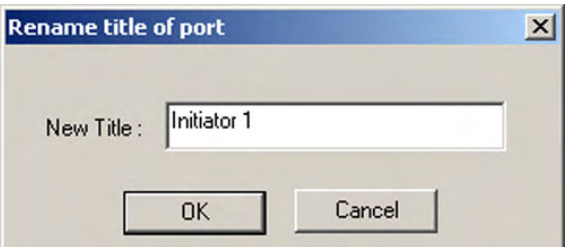

H1
X_RDY
X_RDY
CONT
XXXX
XXXX
XXXX
XXXX
XXXX
Rename title of port
Show
Hide
Apply width to all columns
Software Setting Shift+S
Goto

Figure 3.143: Rename Port

Choose **Rename title of port** to open the Rename Title of Port dialog.


Rename title of port
OK
Cancel

New Title : Initiator 1

Figure 3.144: Rename Title of Port

Show/Hide Single Port

If Show/Hide Single Port is selected, you can click on one port button at a time to show/ hide the capture for that port. Show/Hide Single Port is time consuming as it shows or hides one port at a time.

Show/Hide Multiple Ports

If Show/Hide Multiple Ports is selected, you can click on multiple ports to show or hide them. This mode is much faster. Click on multiple ports to show or hide them.

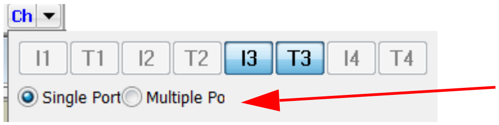

Ch
I1
T1
I2
T2
I3
T3
I4
T4
● Single Port ○ Multiple Po

Figure 3.145: SAS: Show/Hide Ports Toolbar

.

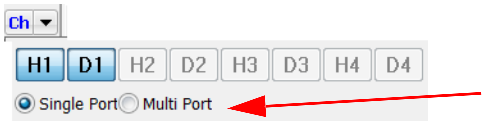

Ch
H1
D1
H2
D2
H3
D3
H4
D4
● Single Port ○ Multi Port

Figure 3.146: SATA: Show/Hide Ports Toolbar

You can also show or hide a port by right-clicking a **Port ID** in Text View or Column View and choosing **Show** or **Hide** (see Figure 3.143).

Show/Hide Field

You can simplify the Viewer display by hiding some fields. You can hide the **Duration**, **Relative Time**, **External Signals,** and **Packet number** fields by right-clicking the corresponding field title and choosing **Hide Field**.

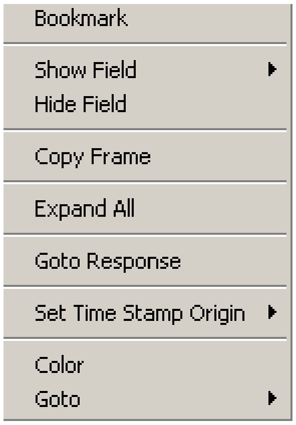

Bookmark
Show Field
Hide Field
Copy Frame
Expand All
Goto Response
Set Time Stamp Origin
Color
Goto

Figure 3.147: Hide Field

To restore a field to the display, right-click a **Port ID** field and choose the hidden field to restore.

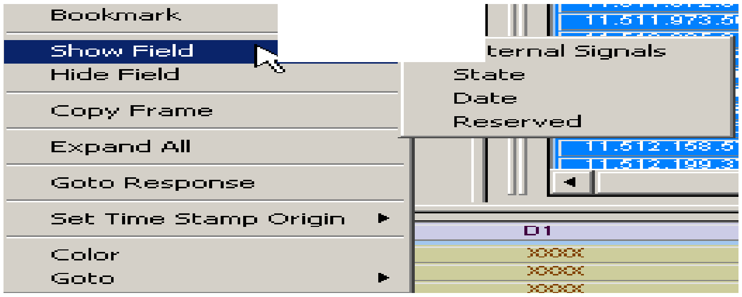

Bookmark
Show Field
Hide Field
Copy Frame
Expand All
Goto Response
Set Time Stamp Origin
Color
Goto
ternal Signals
State
Date
Reserved
11.511.973.5
11.512.158.5
11.512.199.3
D1
XXXX
XXXX
XXXX

Figure 3.148: Show Field

Note: Only the fields previously hidden appear in the restore list.

Related Frames

Right-click a **Command frame** for an SSP frame, or **Register Device to Host** for an STP frame, to open a short-cut menu (see Figure 3.149 on page 232), then choose **Goto Response** to jump to the corresponding Response frame in the viewer.

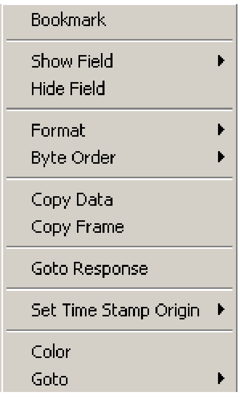

Bookmark
Show Field
Hide Field
Format
Byte Order
Copy Data
Copy Frame
Goto Response
Set Time Stamp Origin
Color
Goto

Figure 3.149: Goto Response

Similarly, right-click a **Response frame** for an SSP Frame, or **Register Device to Host** for an STP frame, to open a short-cut menu, then choose **Goto Command** to jump to the corresponding Command frame in the viewer.

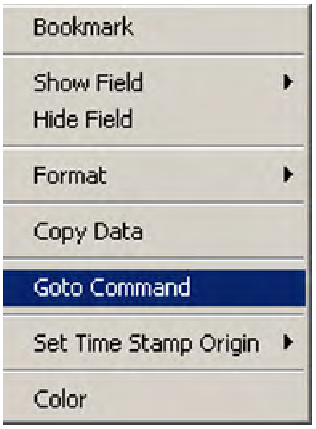

Bookmark
Show Field
Hide Field
Format
Copy Data
Goto Command
Set Time Stamp Origin
Color

Figure 3.150: Goto Command

In Column View, you can right-click a DWORD inside a frame to display the **Goto Within Packet** command. You can jump to an SOF, EOF, HOLD, or R_IP.

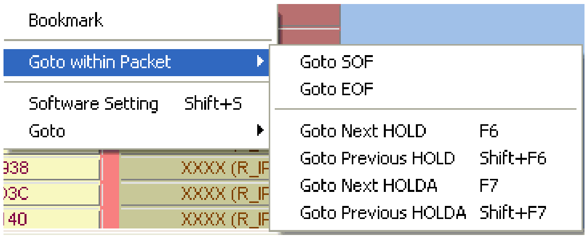

Bookmark
Goto within Packet
Software Setting Shift+S
Goto
Goto SOF
Goto EOF
Goto Next HOLD F6
Goto Previous HOLD Shift+F6
Goto Next HOLDA F7
Goto Previous HOLDA Shift+F7
XXXX (R_IP
XXXX (R_IP
XXXX (R_IP

Figure 3.151: Goto Within Packet Command

Byte Order

You can change the byte order in fields marked by an arrow and other fields.

Right-click in the field, select **Byte Order,** and choose the ordering.

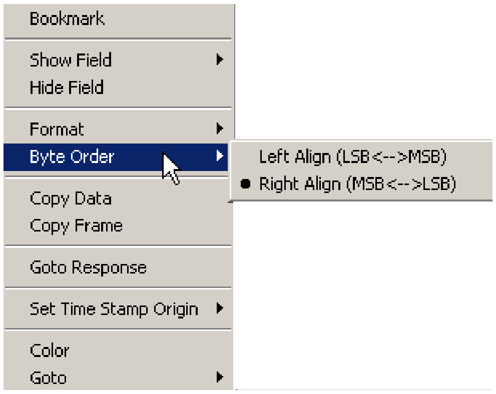

Bookmark
Show Field
Hide Field
Format
Byte Order
Copy Data
Copy Frame
Goto Response
Set Time Stamp Origin
Color
Goto
Left Align (LSB<-->MSB)
● Right Align (MSB<-->LSB)

Figure 3.152: Byte Order

Note: A blue arrow in the byte order field indicates that it has been changed.

Choose Data Format

You can display data values either in hexadecimal (default) or binary. To choose data format, right-click the mouse over a data field, and choose **Format** and the format.

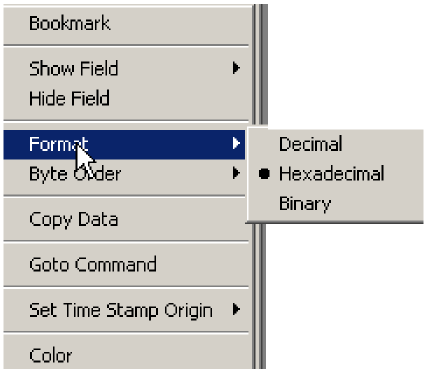
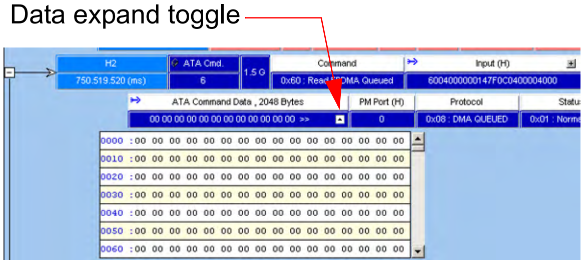

Bookmark
Show Field
Hide Field
Format
Byte Order
Copy Data
Goto Command
Set Time Stamp Origin
Color
Decimal
● Hexadecimal
Binary

Figure 3.153: Format

Show All Data

To display all captured data, click the **data expand** toggle arrow in a data field, to examine the data in detail.

Data expand toggle


H2
750.519.520 (ms)
ATA Cmd.
6
1.5 G
Command
0x60 : Read FPDMA Queued
Input (H)
6004000000147F0C0400004000
ATA Command Data , 2048 Bytes
00 00 00 00 00 00 00 00 00 00 00 00 >>
PM Port (H)
0
Protocol
0x08 : DMA QUEUED
Statu
0x01 : Norma

```
0000 :00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0010 :00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0020 :00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0030 :00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0040 :00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0050 :00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0060 :00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

Figure 3.154: Show All Data

You can expand or collapse all data fields globally. To expand all data fields, right-click the mouse in a data field and choose **Expand All**.

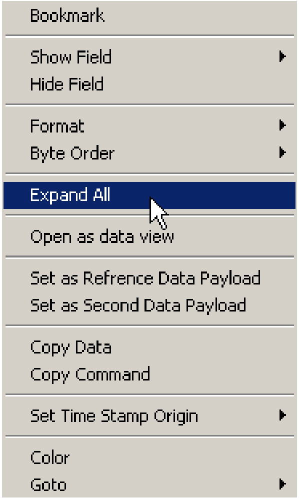

Bookmark
Show Field
Hide Field
Format
Byte Order
Expand All
Open as data view
Set as Refrence Data Payload
Set as Second Data Payload
Copy Data
Copy Command
Set Time Stamp Origin
Color
Goto

Figure 3.155: Expand All

To collapse all fields, right-click the mouse in a data field and choose **Collapse All.**

You can expand or collapse all FIS's and commands. To expand, right-click the mouse in a data field and choose **Expand All FIS's** or **Expand All ATA Cmd.s.** See Figure 3.156.

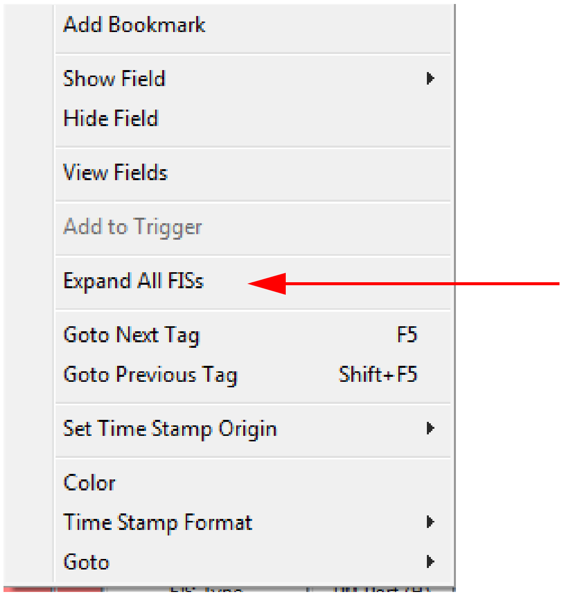

Add Bookmark
Show Field
Hide Field
View Fields
Add to Trigger
Expand All FISs
Goto Next Tag F5
Goto Previous Tag Shift+F5
Set Time Stamp Origin
Color
Time Stamp Format
Goto

Figure 3.156: Expand All FIS's

To collapse, right-click the mouse in a data field and choose **Collapse All FIS's** or **Collapse All ATA Cmd.s.**

You can expand or collapse specific packets and commands by clicking on the ⊞ or ⊟ buttons (see Figure 3.158 on page 235).

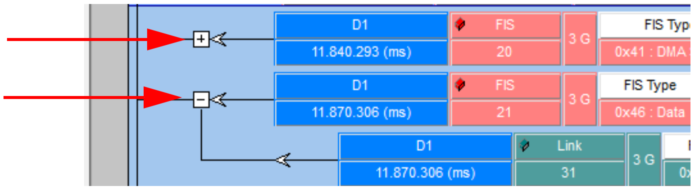
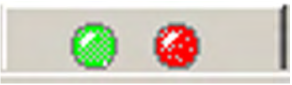

D1
11.840.293 (ms)
FIS
20
3 G
FIS Typ
0x41 : DMA
D1
11.870.306 (ms)
FIS
21
3 G
FIS Type
0x46 : Data
D1
11.870.306 (ms)
Link
31
3 G

Figure 3.157: Expand/Collapse Specific Layers.

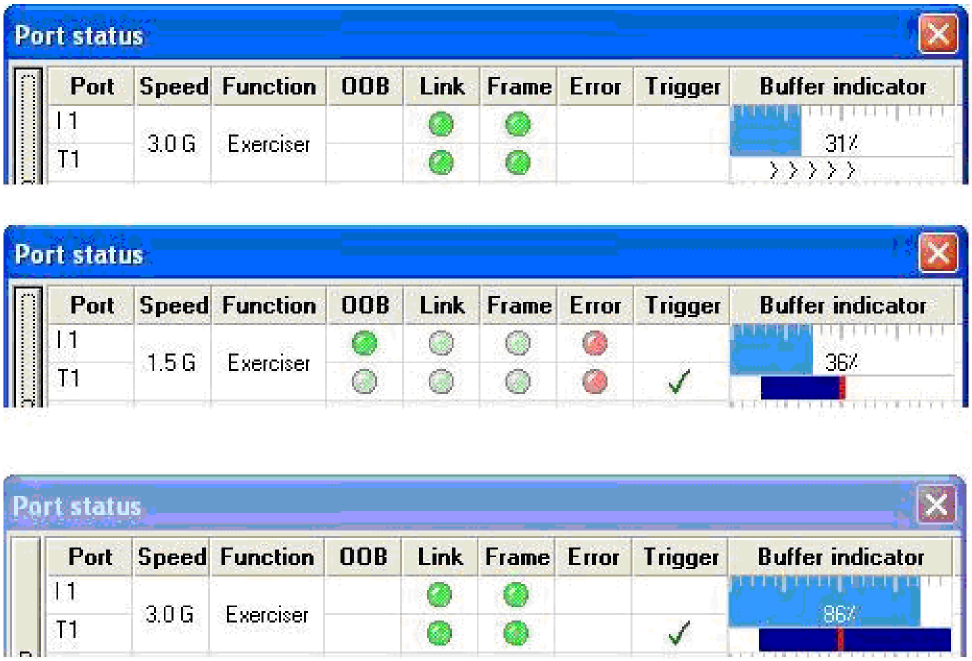
3.10 Port Status

You can get an overview of the active ports by clicking the **Port Status** button at the bottom right of the application window.



The Port Status displays the Port, Speed, and Analyzer.

In addition to displaying OOB, Link, Frame, and Error, a display showing the % buffer full opens when a trigger occurs.


Port status
Port status
Port status

Port	Speed	Function	OOB	Link	Frame	Error	Trigger	Buffer indicator
I1	3.0 G	Exerciser		●	●			31%
T1				●	●			>>>>>

Port	Speed	Function	OOB	Link	Frame	Error	Trigger	Buffer indicator
I1	1.5 G	Exerciser	●	○	○	●		36%
T1			○	○	○	●	✓	

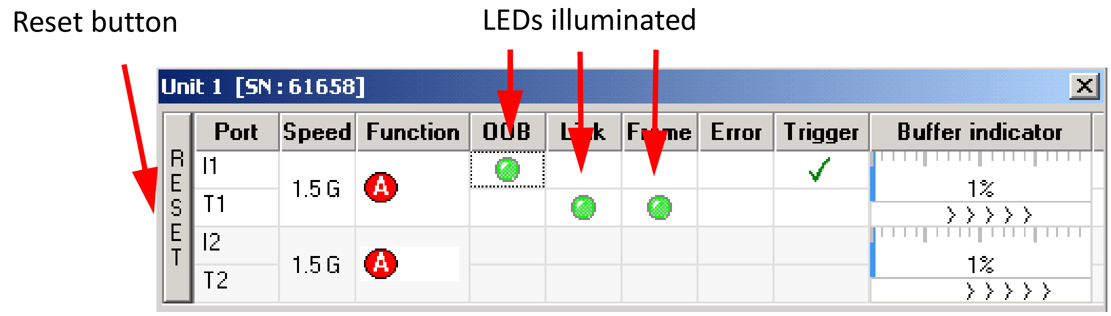
Port	Speed	Function	OOB	Link	Frame	Error	Trigger	Buffer indicator
I1	3.0 G	Exerciser		●	●			86%
T1				●	●		✓	

Figure 3.158: Port Status Window and Capturing Time

1.Pre-trig capturing (trig is 50%)
2. Trig point (shown by red bar; 36% pre trig was captured)
3. Post-trig capturing (50% post-trig was captured and capturing has stopped)

Note: If sample capture occurs with more than one unit active, additional Port Status windows display.

The OOB, Link, Frame and Error LEDs in the Port Status dialog mimic/follow the LEDs on the Front panel of the unit.

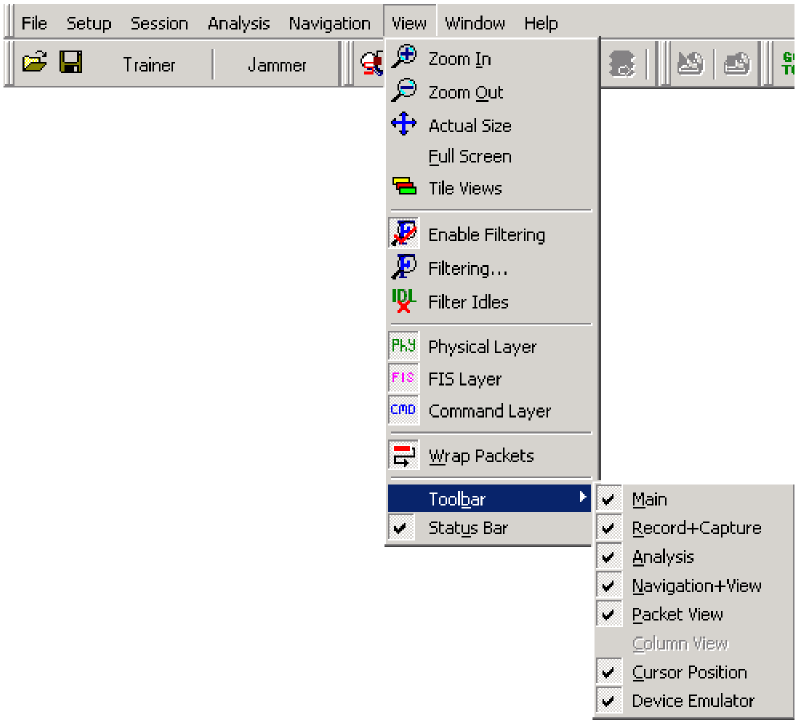

Reset button
LEDs illuminated
Unit 1 [SN : 61658]
RESET
Port
Speed
Function
OOB
Link
Frame
Error
Trigger
Buffer indicator
I1
T1
I2
T2
1.5 G
1.5 G
A
A
1%
1%

When the LEDs are dim, it indicates they were lit in the past. Pressing the Reset button erases this history and the illuminated LEDs are removed from the dialog.

3.11 Toolbars

3.11.1 Enabling Tool Bars

To customize the Viewer Display workspace, you can enable and reposition the available toolbars. To display or hide toolbars, select **View > Toolbar**, then check or uncheck toolbars.


File
Setup
Session
Analysis
Navigation
View
Window
Help
Trainer
Jammer
Zoom In
Zoom Out
Actual Size
Full Screen
Tile Views
Enable Filtering
Filtering...
Filter Idles
Physical Layer
FIS Layer
Command Layer
Wrap Packets
Toolbar
✓ Status Bar
✓ Main
✓ Record+Capture
✓ Analysis
✓ Navigation+View
✓ Packet View
Column View
✓ Cursor Position
✓ Device Emulator

Toolbars are:

- ❑ Main
- ❑ Record + Capture
- ❑ Analysis

- ☐ Navigation + View
- ☐ Packet View
- ☐ Column View
- ☐ Cursor Position

Once enabled, the toolbars can dock at the Viewer Display window or float on the windows desktop.

3.11.2 Cursor Position Status Bar

To display the cursor position status bar, select **View > Status Bar**.

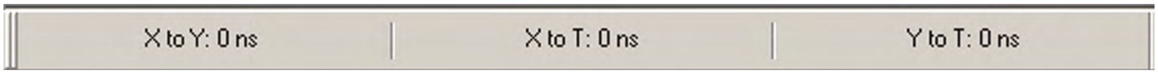


Figure 3.159: Cursor Position Toolbar

See Using the Cursors and Bookmarks on page 237.

3.12 Status Bar

The Status bar is located at the bottom of the main display window.

3.12.1 Search Status

The right most segment displays the current search direction: **Fwd** (forward) or **Bwd** (backward). Change the search direction from the Search Menu or double-click the Search Status segment.

3.13 Using the Cursors and Bookmarks

3.13.1 Cursors

The data viewer display incorporates three cursors labeled **X, Y,** and **T.** All cursors are initially overlaid and positioned at location 0, which is the trigger position of the display. The Trigger, or **T**, cursor is the measurement reference and is always at location 0 in the display.

Positioning the X Cursor

To position the X-Cursor within the viewer data display, click the left mouse button in the gray bar on the left side of the sample viewer next to the line in which to place the cursor.

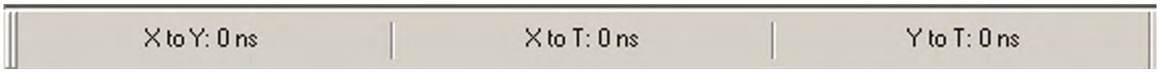
Positioning the Y Cursor

To position the Y-cursor within the viewer data display, click the right mouse button in the gray bar on the left side of the sample viewer next to the line in which to place the cursor.

Note: You can also left-click to set the X-cursor and right-click to set the Y cursor in the Frame and Column View by clicking in the narrow strip on the very left side of a cell. Similarly, you can set the cursors in the Waveform View by left and right clicking at the beginning of a waveform.

Time

Time differences between the cursors are displayed in the Cursor Position toolbar. To display the cursor position toolbar, select **Toolbar** from the view menu and choose Cursor Position.



X to Y: 0 ns

X to T: 0 ns

Y to T: 0 ns

Figure 3.160: Cursor Position Toolbar

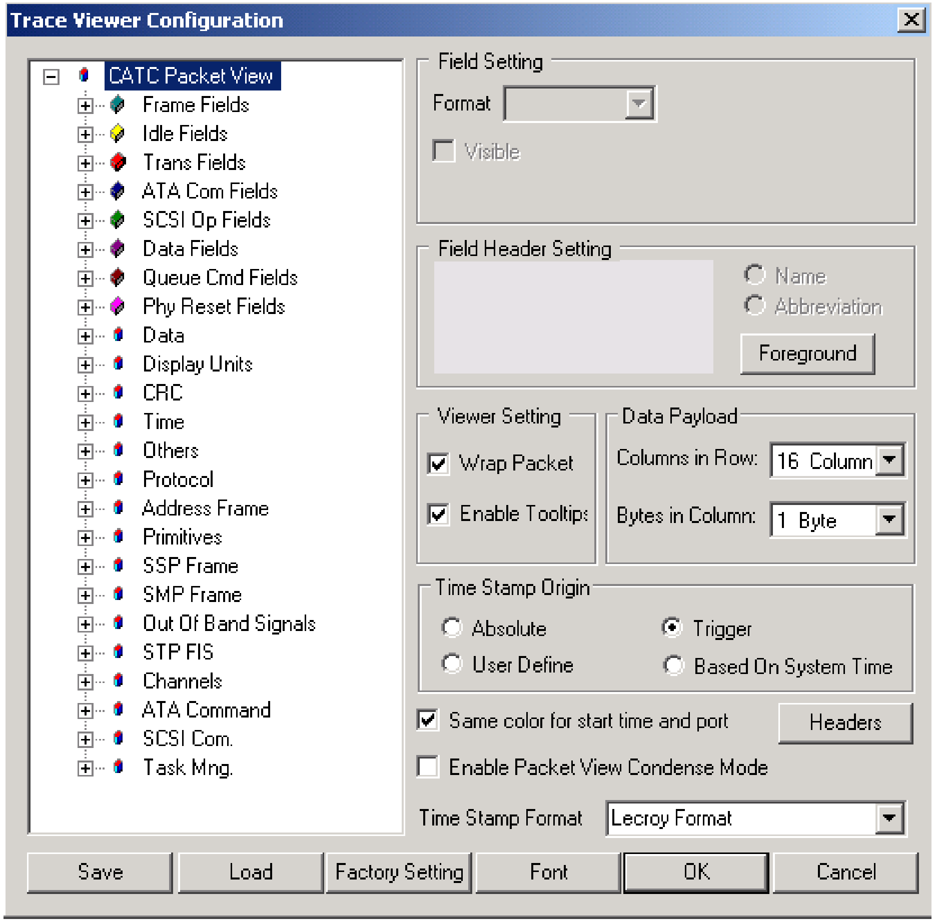
3.14 Display Configuration

The Analyzer ships with a default display configuration of field and viewer settings. You can define your own field and viewer settings for a particular testing scenario. Right-click in the Packet View and select **Preferences** or select **Setup>Preferences>Trace Viewer>Configuration.** The Trace Viewer Configuration dialog displays (see Figure 3.161 on page 239).

3.14.1 Trace Viewer Configuration

The Trace Viewer Configuration dialog allows you to change the following display settings:

- Field Setting
  - Format (Decimal, Hexadecimal, Binary)
  - Visible
  - Byte Order (Right Align, Left Align)
- Field Header Setting
  - Text (color)
  - Name
  - Abbreviation
  - Foreground (color)
- Viewer Setting
  - Wrap Packet
  - Enable Tooltips
- Data Payload
  - Columns in Row (1, 2, 4, 8, 16)
  - Bytes in Column (1, 2, 4, 8, 16)
- Time Stamp Origin: Absolute, Trigger, User Defined, Based on System Time
- Same color for start time and port
- Enable Packet View Condense Mode
- Time Stamp Format (LeCroy, Milli, Micro)
- Save Trace Viewer Configuration in a file
- Load Trace Viewer Configuration from a file
- Factory Setting (restores default settings)
- Font (opens Font dialog)


Trace Viewer Configuration
CATC Packet View
Frame Fields
Idle Fields
Trans Fields
ATA Com Fields
SCSI Op Fields
Data Fields
Queue Cmd Fields
Phy Reset Fields
Data
Display Units
CRC
Time
Others
Protocol
Address Frame
Primitives
SSP Frame
SMP Frame
Out Of Band Signals
STP FIS
Channels
ATA Command
SCSI Com.
Task Mng.
Field Setting
Field Header Setting
Foreground
Viewer Setting
Data Payload
Time Stamp Origin
Headers
Save
Load
Factory Setting
Font
OK
Cancel

Format

☐ Visible

○ Name

○ Abbreviation

☑ Wrap Packet

☑ Enable Tooltips

Columns in Row: 16 Column

Bytes in Column: 1 Byte

○ Absolute

● Trigger

○ User Define

○ Based On System Time

☑ Same color for start time and port

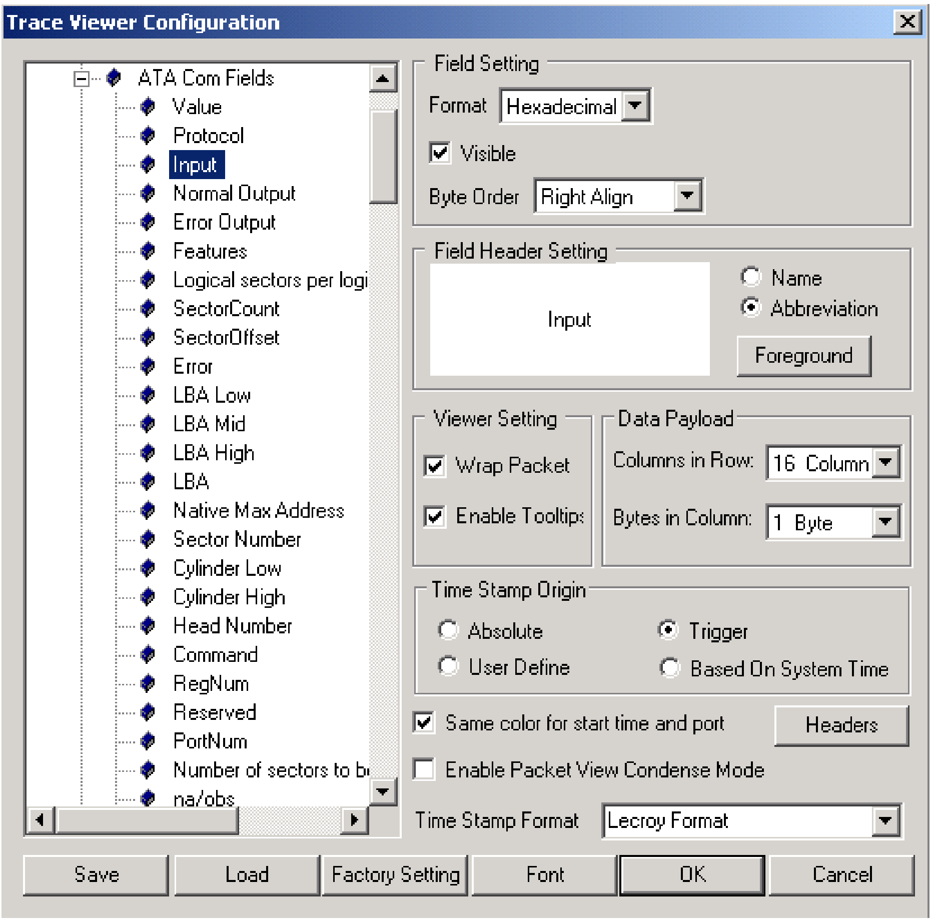
☐ Enable Packet View Condense Mode

Time Stamp Format: Lecroy Format

Figure 3.161: Trace Viewer Configuration

Field Settings

To view a packet field, select a field from the packet field tree and check the **Visible** box. Uncheck it to hide the field. To change the data format of a packet field, select the field and choose a data format from the Format drop-down list.



Trace Viewer Configuration

- ATA Com Fields
  - Value
  - Protocol
  - Input
  - Normal Output
  - Error Output
  - Features
  - Logical sectors per logi
  - SectorCount
  - SectorOffset
  - Error
  - LBA Low
  - LBA Mid
  - LBA High
  - LBA
  - Native Max Address
  - Sector Number
  - Cylinder Low
  - Cylinder High
  - Head Number
  - Command
  - RegNum
  - Reserved
  - PortNum
  - Number of sectors to b
  - na/obs

Field Setting

Format: Hexadecimal

☑ Visible

Byte Order: Right Align

Field Header Setting

Input

○ Name
● Abbreviation

Viewer Setting

☑ Wrap Packet
☑ Enable Tooltips

Data Payload

Columns in Row: 16 Column
Bytes in Column: 1 Byte

Time Stamp Origin

○ Absolute ● Trigger
○ User Define ○ Based On System Time

☑ Same color for start time and port
☐ Enable Packet View Condense Mode

Time Stamp Format: Lecroy Format

Figure 3.162: ATA Command Fields

Field Header Setting

You can use the Name or Abbreviation.

To change the color of the text in a packet field header, select a field from the packet field tree and click the **Foreground** button.

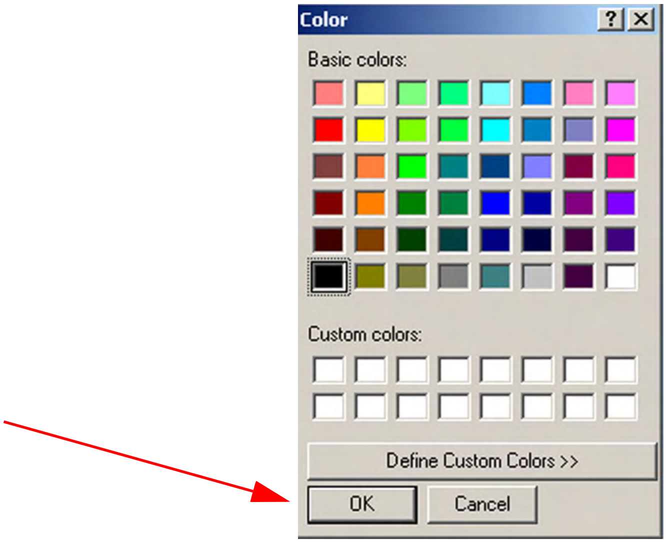


Figure 3.163: Color

Choose an appropriate color and click **OK.**

Viewer Setting

Check the **Wrap Packet** box to enable the wrapping of packets in the display.

Check the **Enable Tooltip** box to enable tool tips for packet fields.

Data Payload

You can format the Data Payload display.

For Columns in Row, select 1, 2, 4, 8, or 16.

For Bytes in Column, select 1, 2, 4, 8, or 16.

Time Stamp Origin

Select Absolute, User Defined, Trigger, or Based on System Time.

Start Time and Port

You can use the same color for the start time and port.

Packet View Condense Mode

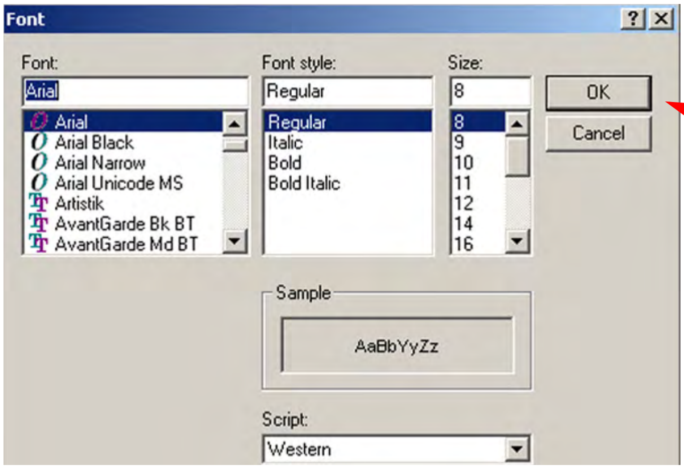
You can enable Packet View Condense Mode to minimize Packet View rows.

Time Stamp Format

Select Teledyne LeCroy, Milliseconds, or Microseconds.

Font

To change display fonts, click the **Font** button to open the Font dialog box.


Font
? ×
Arial
Arial Black
Arial Narrow
Arial Unicode MS
Artistik
AvantGarde Bk BT
AvantGarde Md BT
Regular
Italic
Bold
Bold Italic
8
9
10
11
12
14
16
OK
Cancel
Sample
AaBbYyZz

Font: Arial
Font style: Regular
Size: 8
Script: Western

Figure 3.164: Font

Choose the font, font style, and size, and click **OK.**

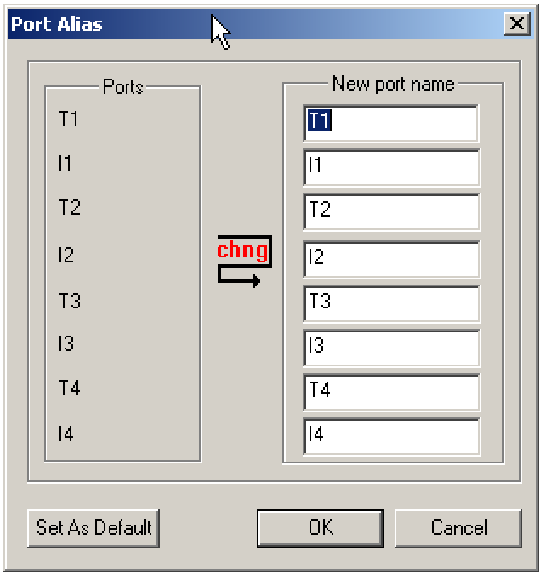
Save/Load Settings

You can save the customized configuration settings in a ***.cfg** file by clicking the **Save** button and completing the Save As procedure. To load a previously saved configuration file, click **Load** and choose an appropriate file.

3.15 Set Port Alias

Port Alias allows you to assign a meaningful name to each port to assist in interpreting the results displayed in the sample view (see Figure 3.165 on page 243).

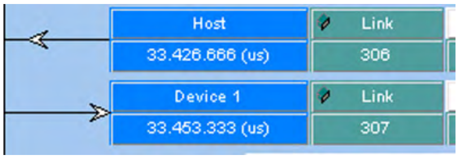
To assign port names in an open sample view, select **Setup > Set Port Alias**.


Port Alias
×
chng
Set As Default
OK
Cancel

Ports	New port name
T1	T1
I1	I1
T2	T2
I2	I2
T3	T3
I3	I3
T4	T4
I4	I4

Figure 3.165: SAS: Assign Port Alias

Assign a meaningful name to each port in use and click **OK**. The assigned names replace the port numbers in the sample view.



If you elect to save the capture sample file, the assigned port names are saved together with the result, so that when you open the sample file later, the assigned names are retained.

Restore Factory Presets

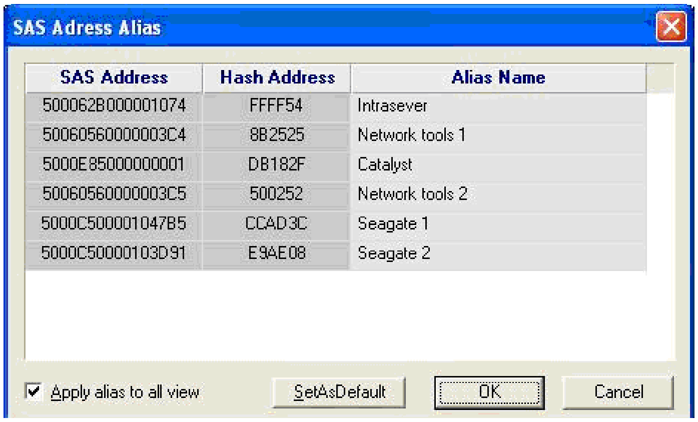
Click the **Restore Factory Presets** button to restore the settings to the factory settings.

Set As Default

If you want to set these port aliases for sample files that will be captured later, you can set them as default, and new samples will be opened by these default port aliases.

3.16 SAS Address Alias (SAS only)

SAS Address Alias allows you to assign a meaningful name to each SAS address to assist in interpreting the results displayed in the sample view. To assign SAS address names in an open sample view, select **Setup > Set SAS Address Alias** (see Figure 3.166 on page 243).

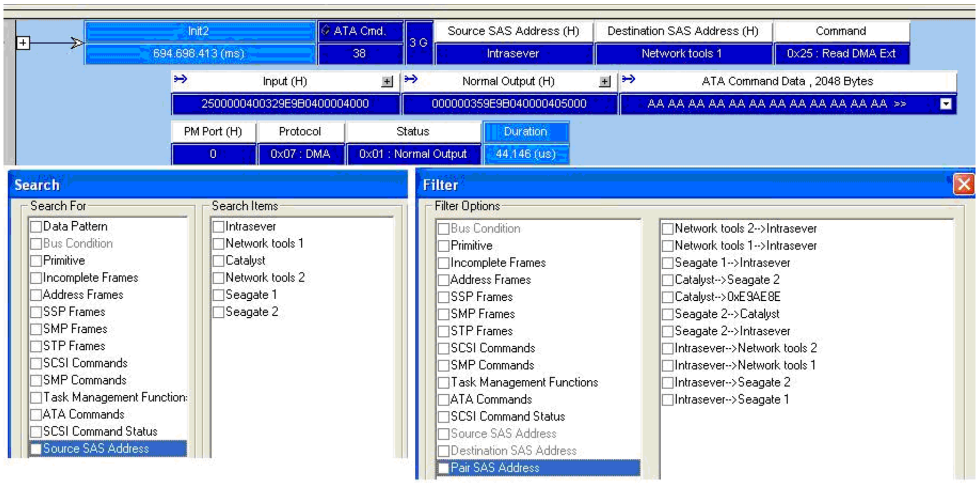


SAS Address	Hash Address	Alias Name
500062B000001074	FFFF54	Intrasever
50060560000003C4	8B2525	Network tools 1
5000E85000000001	DB182F	Catalyst
50060560000003C5	500252	Network tools 2
5000C500001047B5	CCAD3C	Seagate 1
5000C50000103D91	E9AE08	Seagate 2

☑ Apply alias to all view

Figure 3.166: SAS: Assign SAS Address Alias

Assign a meaningful name to each SAS address in use and click **OK**. The assigned names replace the SAS address in the sample view, Search, filter, and Statistical report (see Figure 3.167 on page 244).



Init2	ATA Cmd.	3 G	Source SAS Address (H)	Destination SAS Address (H)	Command
694.698.413 (ms)	38		Intrasever	Network tools 1	0x25 : Read DMA Ext

Input (H)	Normal Output (H)	ATA Command Data , 2048 Bytes
2500000400329E9B0400004000	000000359E9B040000405000	AA AA AA AA AA AA AA AA AA AA AA AA >>

PM Port (H)	Protocol	Status	Duration
0	0x07 : DMA	0x01 : Normal Output	44.146 (us)

Search
Search For
☐Data Pattern
☐Bus Condition
☐Primitive
☐Incomplete Frames
☐Address Frames
☐SSP Frames
☐SMP Frames
☐STP Frames
☐SCSI Commands
☐SMP Commands
☐Task Management Function:
☐ATA Commands
☐SCSI Command Status
☐Source SAS Address
Search Items
☐Intrasever
☐Network tools 1
☐Catalyst
☐Network tools 2
☐Seagate 1
☐Seagate 2
Filter
Filter Options
☐Bus Condition
☐Primitive
☐Incomplete Frames
☐Address Frames
☐SSP Frames
☐SMP Frames
☐STP Frames
☐SCSI Commands
☐SMP Commands
☐Task Management Functions
☐ATA Commands
☐SCSI Command Status
☐Source SAS Address
☐Destination SAS Address
☐Pair SAS Address
☐Network tools 2-->Intrasever
☐Network tools 1-->Intrasever
☐Seagate 1-->Intrasever
☐Catalyst-->Seagate 2
☐Catalyst-->0xE9AE8E
☐Seagate 2-->Catalyst
☐Seagate 2-->Intrasever
☐Intrasever-->Network tools 2
☐Intrasever-->Network tools 1
☐Intrasever-->Seagate 2
☐Intrasever-->Seagate 1

Figure 3.167: SAS: SAS Address Alias

If you elect to save the captured sample file, the assigned SAS address names are saved together with the result, so that when you open the sample file later, the assigned names are retained.

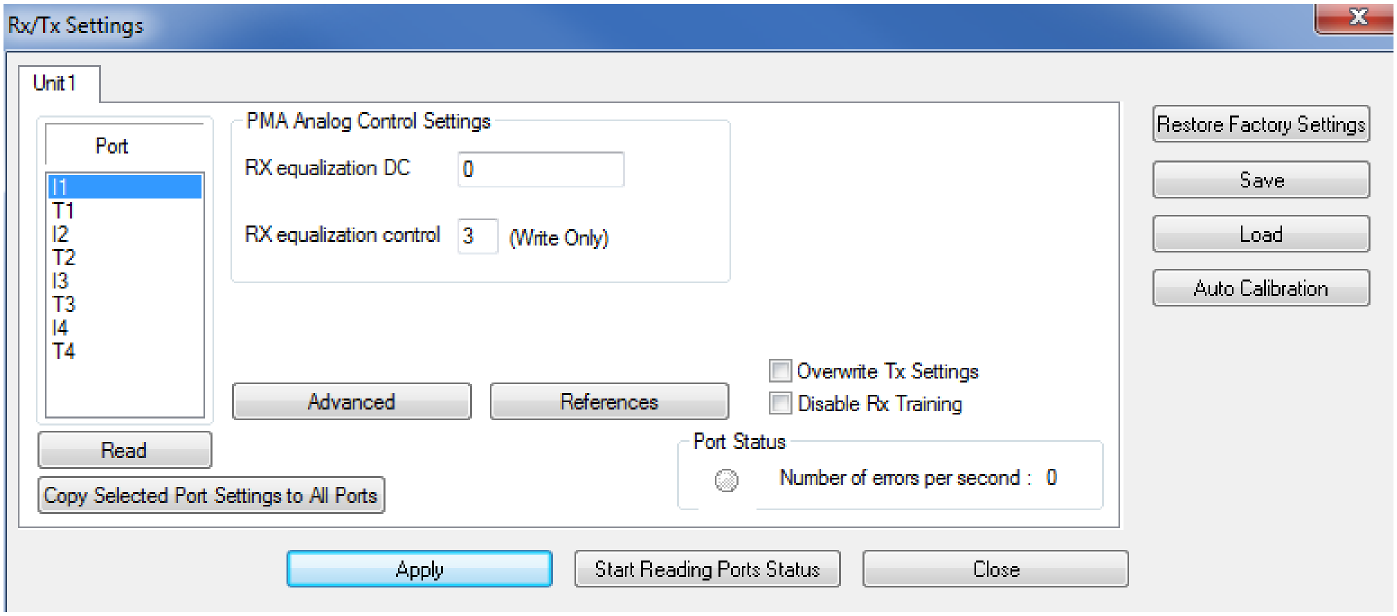
Set As Default

If you want to set these SAS address aliases for sample files that will be captured later, you can set them as default, and new samples will be opened by these default SAS address aliases.

3.17 TxRxVout & Preemphasis

The analyzer incorporates the ability to select TxRx Vout for the transmitter and receiver on each port. Using TxRx Vout can increase the output voltage swing above the nominal value, for test and characterization purposes. This feature is also useful to compensate for line loss when driving long cables.

To select TX Vout, select **Setup > TxRx Vout & Preemphasis** to display the Rx/Tx Settings dialog:


Rx/Tx Settings
Unit 1
Port
I1
T1
I2
T2
I3
T3
I4
T4
Read
Copy Selected Port Settings to All Ports
PMA Analog Control Settings
Advanced
References
Port Status
Restore Factory Settings
Save
Load
Auto Calibration
Apply
Start Reading Ports Status
Close

RX equalization DC 0

RX equalization control 3 (Write Only)

☐ Overwrite Tx Settings

☐ Disable Rx Training

Number of errors per second : 0

Figure 3.168: Choose Port for TxRx Vout.

Port displays ports to select from.

Copy Selected Port Settings to All Ports implements selected port's setting into all other port settings.

PMA Analog Control Settings allows you to select values for RX equalization DC and RX equalization (write only).

Advanced displays the Advanced Probe Setting dialog. (See Advanced Probe Setting on page 246.)

References displays the References Probe Setting dialog. (See References Probe Setting on page 246.)

Overwrite Tx Settings check this box to overwrite the Tx settings. (See Overwrite Tx Settings on page 248.)

Disable Rx Training check this box to use the manually entered settings.

Port Status displays number of errors per second.

Apply applies the selected settings.

Start Reading Port Status implements reading of number of errors displayed in Port Status.

Restore Factory Settings restores default values.

Save saves the new values as a ***.sng** file.

Load loads back the saved ***.sng** file.

Auto Calibration displays the Auto Probe Calibration dialog. (See Auto Probe Calibration on page 249.)

3.17.1 Advanced Probe Setting

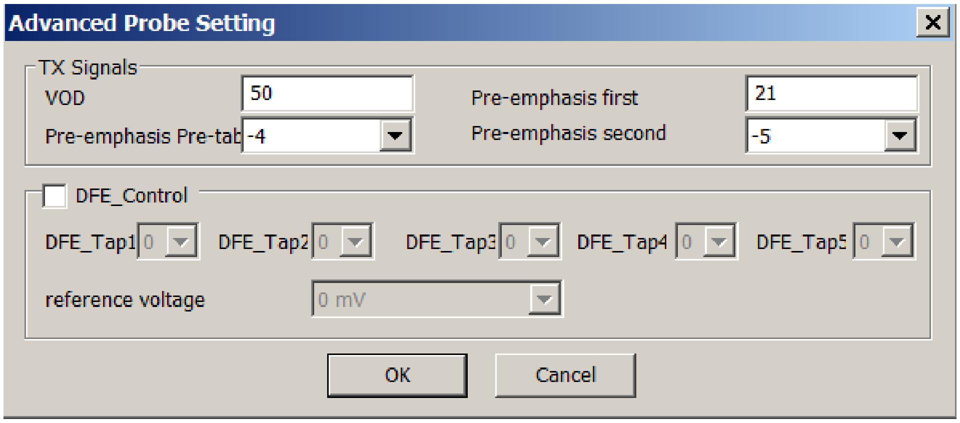
The Advanced Probe Setting dialog allows you to set the TX Signals and DFE_Control (Decision Feedback Equalization) parameters.

You can set the TX Signals values for:

- VOD (Programmable Differential Voltage)
- Pre-emphasis Pre-tab
- Pre-emphasis first
- Pre-emphasis second

You can set the DFE_Control values for:

- DFE_Tap1
- DFE_Tap2
- DFE_Tap3
- DFE_Tap4
- DFE_Tap5
- reference voltage



Advanced Probe Setting

TX Signals

VOD: 50

Pre-emphasis Pre-tab: -4

Pre-emphasis first: 21

Pre-emphasis second: -5

☐ DFE_Control

DFE_Tap1: 0

DFE_Tap2: 0

DFE_Tap3: 0

DFE_Tap4: 0

DFE_Tap5: 0

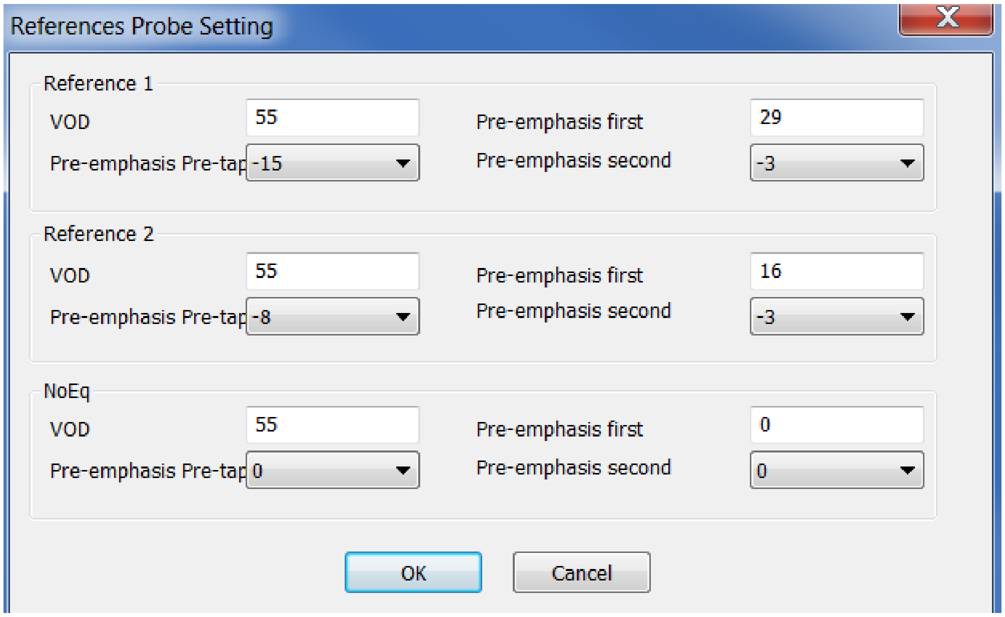
reference voltage: 0 mV

Figure 3.169: Advanced Probe Setting Dialog.

3.17.2 References Probe Setting

The References Probe Setting dialog (see Figure 3.170 on page 247) allows you to set the three reference points defined by the SAS 3.0 specification (Reference 1, Reference 2 and NoEq), in cases when the default reference points do not result in a clean link.

These settings only need to be applied once for each analyzer as they are saved by the SAS/SATA Protocol Suite application on the host machine. Connecting to a different host machine requires reapplying the settings.



References Probe Setting

Reference 1

VOD: 55

Pre-emphasis Pre-tap: -15

Pre-emphasis first: 29

Pre-emphasis second: -3

Reference 2

VOD: 55

Pre-emphasis Pre-tap: -8

Pre-emphasis first: 16

Pre-emphasis second: -3

NoEq

VOD: 55

Pre-emphasis Pre-tap: 0

Pre-emphasis first: 0

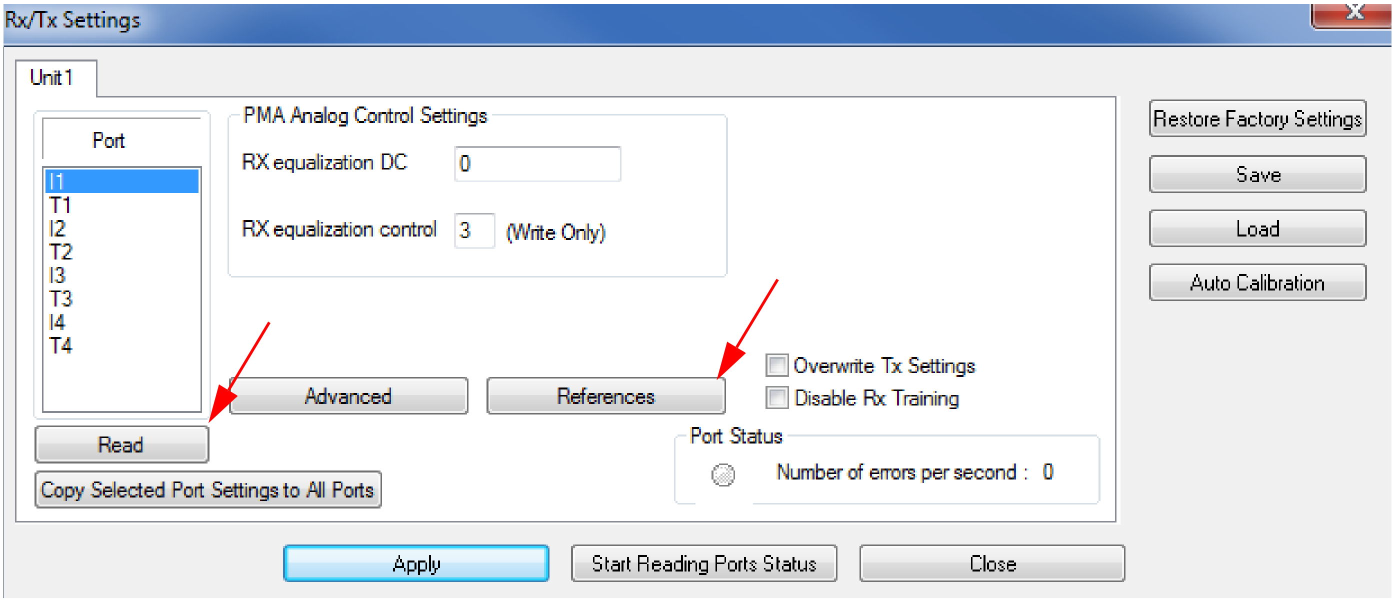
Pre-emphasis second: 0

Figure 3.170: References Probe Setting Dialog.

3.17.3 Manual Calibration of Tx Path from Jammer

To manually calibrate perform the following steps:

1. Select **Setup > TxRx Vout & Preemphasis** to display the Rx/Tx Settings dialog (see Figure 3.171 on page 247).
2. Press the **Read** button to read the current values for all ports (values achieved through automatic Training when the link has come up), then press the **Advanced** button to see and tweak the values.
3. The typical set of values for the Initiator are shown in Figure 3.172 on page 248. If you see these values then no changes are required.



Rx/Tx Settings

Unit 1

Port: I1, T1, I2, T2, I3, T3, I4, T4

PMA Analog Control Settings

RX equalization DC: 0

RX equalization control: 3 (Write Only)

☐ Overwrite Tx Settings

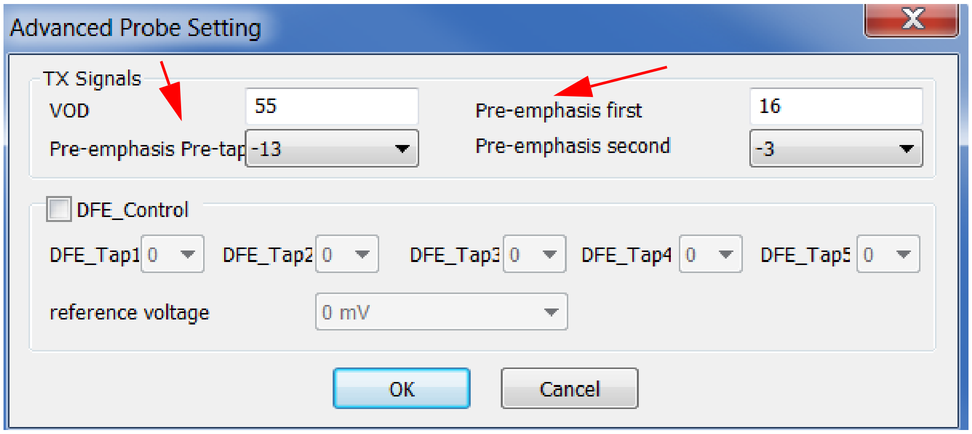
☐ Disable Rx Training

Port Status

Number of errors per second : 0

Restore Factory Settings
Save
Load
Auto Calibration
Advanced
References
Read
Copy Selected Port Settings to All Ports
Apply
Start Reading Ports Status
Close

Figure 3.171: Rx/Tx Settings Dialog.


Advanced Probe Setting
TX Signals
OK
Cancel

VOD 55

Pre-emphasis first 16

Pre-emphasis Pre-tap -13

Pre-emphasis second -3

☐ DFE_Control

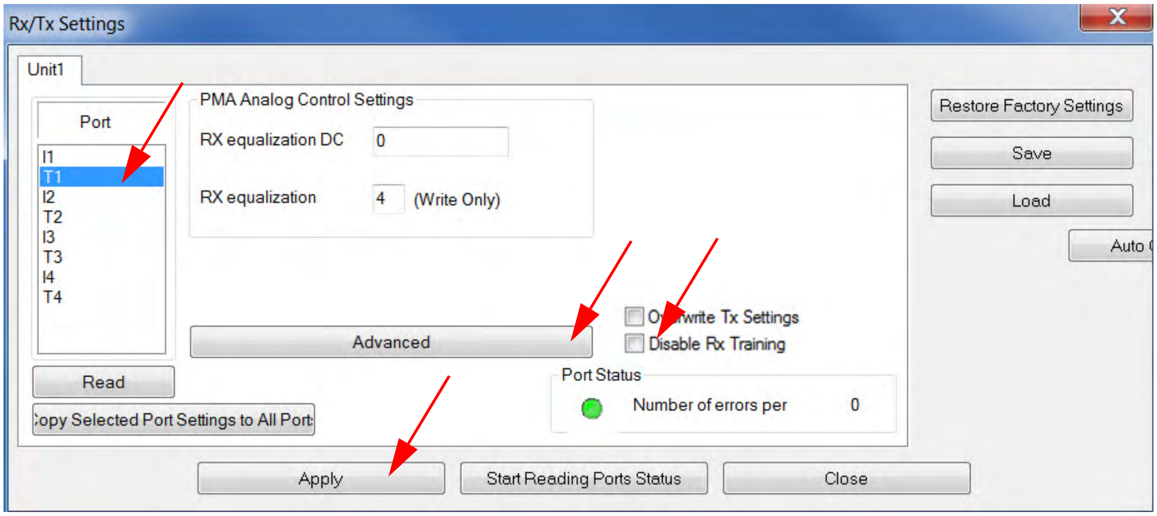
DFE_Tap1 0
DFE_Tap2 0
DFE_Tap3 0
DFE_Tap4 0
DFE_Tap5 0

reference voltage 0 mV

Figure 3.172: Advanced Probe Setting Dialog.

4. To see the Target values, click **Cancel** on the Advanced Probe Setting dialog.
5. Select T1 on the Rx/Tx Setting dialog (see Figure 3.173 on page 248), and then click the **Advanced** button (no need to re-read the values).
6. Manipulate the "Pre-emphasis first" and "Pre-emphasis pre-tap" fields by making small changes to the values achieved by Training (see Figure 3.172). This is an iterative process to eliminate errors.
7. After you change each value, press **OK** to make the change in the software copy of the value.
8. Press **Apply** in the Rx/Tx Settings (see Figure 3.173 on page 248) dialog to write the new value to the Serdes.

Note: If you press **Close**, then the values will not be written to the Serdes.


Rx/Tx Settings
Unit1
Port
I1
T1
I2
T2
I3
T3
I4
T4
Read
Copy Selected Port Settings to All Ports
PMA Analog Control Settings
Advanced
Port Status
Restore Factory Settings
Save
Load
Auto
Apply
Start Reading Ports Status
Close

RX equalization DC 0

RX equalization 4 (Write Only)

☐ Overwrite Tx Settings

☐ Disable Rx Training

Number of errors per 0

Figure 3.173: Rx/Tx Settings Dialog.

Overwrite Tx Settings

Check this box (see Figure 3.173) to retain the optimal values reached through manual calibration every time the link goes through Training due to port reset, power cycle or disconnection.

3.17.4 Auto Probe Calibration

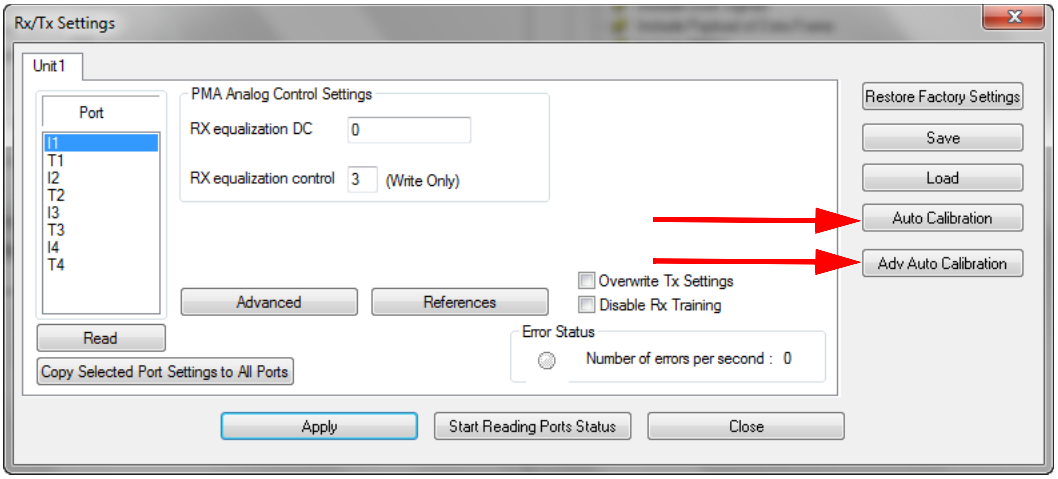
The Auto Probe Calibration dialog attempts to optimize the receiver settings. The accuracy depends on the time spent on each setting. Note that this action may take a long time, depending on the values entered.

Auto Calibration

Standard Auto Calibration is performed by firmware, and it is relatively fast, but it may not be sufficient.

Advanced Auto Calibration

A more precise, but slower Advanced Auto Calibration is performed by the software, and attempts to cover the whole solution space. It may take as long as an hour.


Rx/Tx Settings
Unit 1
Port
I1
T1
I2
T2
I3
T3
I4
T4
PMA Analog Control Settings
Restore Factory Settings
Save
Load
Auto Calibration
Adv Auto Calibration
Advanced
References
Read
Copy Selected Port Settings to All Ports
Error Status
Apply
Start Reading Ports Status
Close

RX equalization DC 0

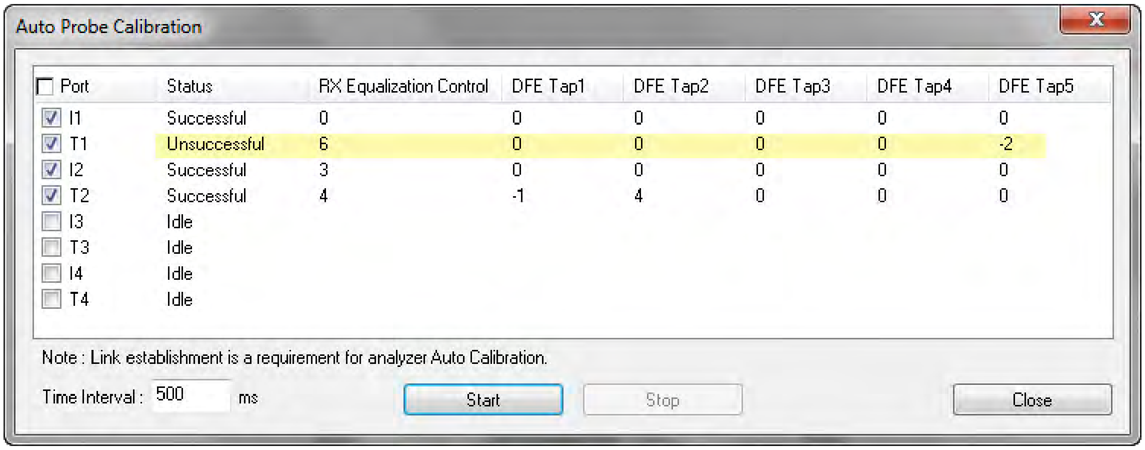
RX equalization control 3 (Write Only)

☐ Overwrite Tx Settings

☐ Disable Rx Training

Number of errors per second : 0

Figure 3.174: Selections for Auto Calibration and Advance Auto Calibration.

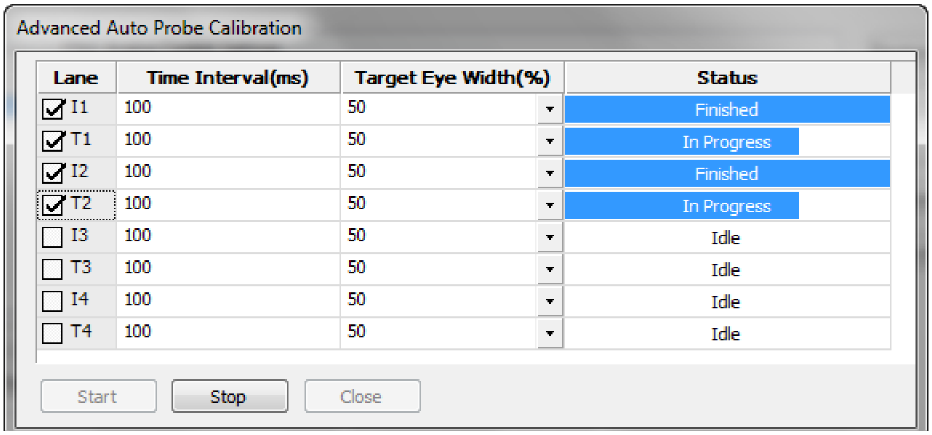

Auto Probe Calibration
Start
Stop
Close

☐ Port	Status	RX Equalization Control	DFE Tap1	DFE Tap2	DFE Tap3	DFE Tap4	DFE Tap5
☑ I1	Successful	0	0	0	0	0	0
☑ T1	Unsuccessful	6	0	0	0	0	-2
☑ I2	Successful	3	0	0	0	0	0
☑ T2	Successful	4	-1	4	0	0	0
☐ I3	Idle						
☐ T3	Idle						
☐ I4	Idle						
☐ T4	Idle						

Note : Link establishment is a requirement for analyzer Auto Calibration.

Time Interval : 500 ms

Figure 3.175: Auto Probe Calibration Dialog.



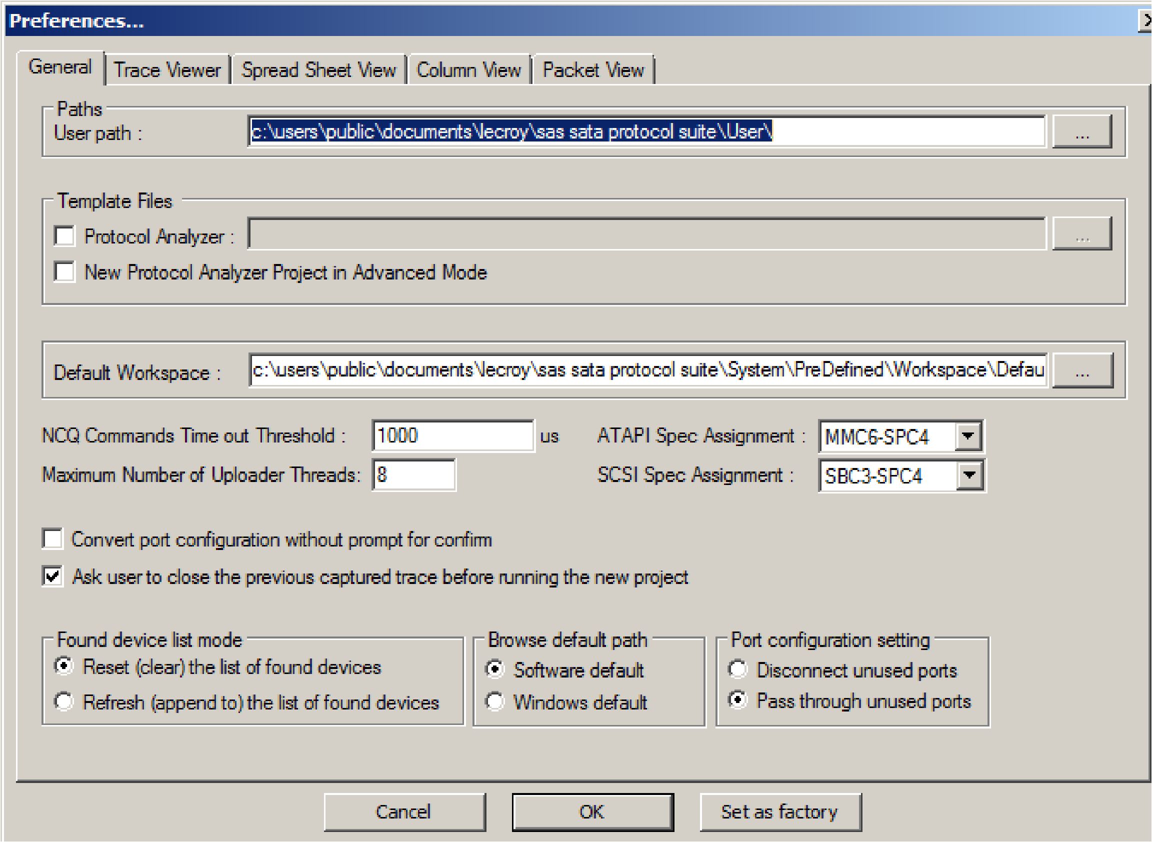
Lane	Time Interval(ms)	Target Eye Width(%)	Status
☑ I1	100	50	Finished
☑ T1	100	50	In Progress
☑ I2	100	50	Finished
☑ T2	100	50	In Progress
☐ I3	100	50	Idle
☐ T3	100	50	Idle
☐ I4	100	50	Idle
☐ T4	100	50	Idle

Figure 3.176: Advanced Auto Probe Calibration.

3.18 Preferences

Preferences allows you to define template files for new Analyzer projects, to specify how sample files appear when opened, and to set ATAPI and SCSI Spec Assignments. Click **Setup** on the toolbar and choose **Preferences** to display the General tab (see General Tab on page 250.)

3.18.1 General Tab



Paths
User path : c:\users\public\documents\lecroy\sas sata protocol suite\User\

Template Files
☐ Protocol Analyzer :
☐ New Protocol Analyzer Project in Advanced Mode

Default Workspace : c:\users\public\documents\lecroy\sas sata protocol suite\System\PreDefined\Workspace\Defau

NCQ Commands Time out Threshold : 1000 us
Maximum Number of Uploader Threads: 8
ATAPI Spec Assignment : MMC6-SPC4
SCSI Spec Assignment : SBC3-SPC4

☐ Convert port configuration without prompt for confirm
☑ Ask user to close the previous captured trace before running the new project

Found device list mode
● Reset (clear) the list of found devices
○ Refresh (append to) the list of found devices

Browse default path
● Software default
○ Windows default

Port configuration setting
○ Disconnect unused ports
● Pass through unused ports

Figure 3.177: Preferences Dialog General Tab.

Paths

User Path specifies the “User” folder path, used by the software after launching the Open dialog.

Template Files

Protocol Analyzer: You can use a pre-saved analyzer and/or analyzer project file as a template. Whenever you make a new project file, the software uses the template to initialize the project file.

New Protocol Analyzer Project in Advanced Mode: When you use the New menu item to create a new project file, the software switches to Advanced mode automatically.

Other

Default Workspace specifies the default workspace file for opening a sample file. You can save any viewer configuration as a workspace and then specify it as the default workspace. The software always open a trace file based on the default workspace file.

NCQ Commands Time out Threshold: The software uses this setting in the statistical ATA command page for NCQ commands. If the time out exceeds this setting, the software reports an error.

Maximum Number of Uploader Threads: If Quick View is not enabled, during cascading, specifies the number of concurrent processes for uploading a sample file.

ATAPI spec assignment: Specifies the ATAPI default spec.

SCSI spec assignment (SAS only): Specifies the SCSI default spec.

Convert port configuration without prompt for confirm: If the current attached board does not support the project file port configuration, the software converts it to a supported port configuration without asking for confirmation. If this setting is unchecked, the software asks for confirmation

Ask user to close the previous captured sample before running the new project: When you start to run a new project, the software prompts you to close the current sample.

Found Device List Mode

Reset (clear) the list of found devices: Lists only the currently found devices.

Refresh (append to) the list of found devices: Adds new devices to the list of devices found previously.

Browse Default Path

Software default: After you select **File > Open**, the Open dialog shows the default user folder.

Windows default: After you select **File > Open**, the Open dialog shows the path selected when the Open dialog was last used.

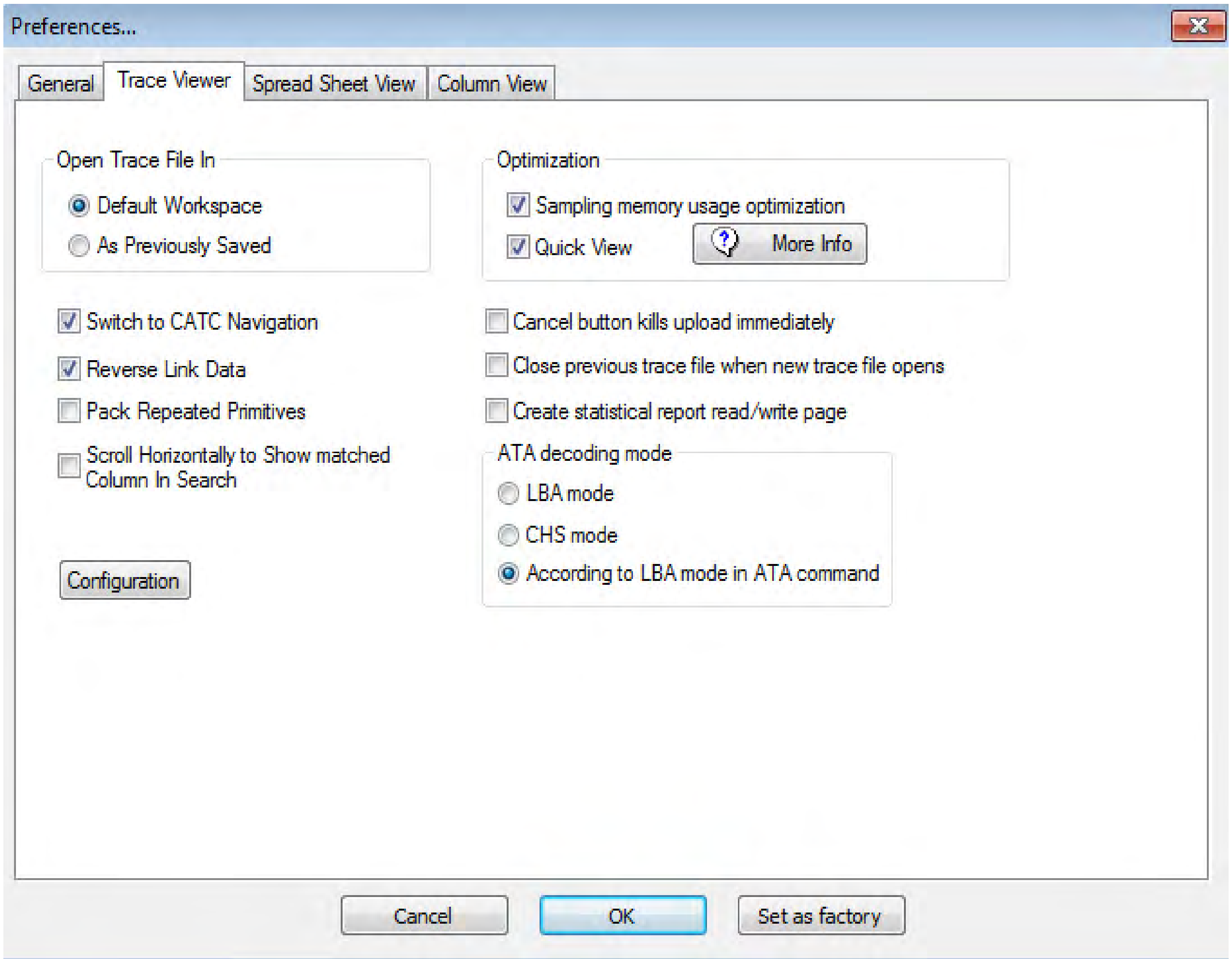
Port Configuration Setting

These options pertain to Port Configurations that have unused ports (as marked by a dash in the Port Configuration table, e.g. AA--). This allows the user to control these ports, if unused by the analyzer platform, are to be disconnected or are to be used as pass through, meaning the traffic will simply pass through them (default setting). It is sometimes useful to force disconnect on unused ports, to cause all traffic to pass through the used ports. Select the desired option:

Disconnect unused ports

Pass through unused ports

3.18.2 Trace Viewer Tab



Open Trace File In
● Default Workspace
○ As Previously Saved

Optimization
☑ Sampling memory usage optimization
☑ Quick View

☑ Switch to CATC Navigation
☑ Reverse Link Data
☐ Pack Repeated Primitives
☐ Scroll Horizontally to Show matched Column In Search

☐ Cancel button kills upload immediately
☐ Close previous trace file when new trace file opens
☐ Create statistical report read/write page

ATA decoding mode
○ LBA mode
○ CHS mode
● According to LBA mode in ATA command

Figure 3.178: Preferences Dialog Trace Viewer Tab

Open Trace file In

Default Workspace: The software opens a **trace** file in view(s) based on the specified default workspace.

As previously saved: The software opens a trace file in view (views) based on the last saved configuration for the **trace** file.

Optimization

Sampling memory usage optimization: Enables memory cascading for two ports. The analyzer will use memory of another port if there is not data on another port. (see Sampling Memory Usage Optimization on page 258)

Quick View: Quick View allows full access to the whole trace more quickly, especially when using a Gigabit Ethernet connection. However, the trace is NOT written to the host machine’s hard drive. To save the trace, you must manually click **Save**.
If you do not check Quick View, the trace loads more slowly but is automatically saved to the host machine’s hard drive.

Other

Switch to CATC Navigation: Packet view will open in CATC mode.

Reverse Link Data: The software shows DWORDs of link data as reversed.

Pack Repeated Primitives: The software packs repeated primitives just after opening a sample file.

Scroll Horizontally to Show matched Column in Search: When unchecked makes columns stationary even during search.

Use new PHY capabilities decoding: Decodes PHY capability bits in reverse order per the latest specification.

Cancel button kills upload immediately: The software kills the uploading process if you press **Cancel**.

Close previous sample file when new sample file opens: When you want to open a new sample file, the software closes any open sample files.

Create statistical report read/write page: The software creates a Read/Write page in the statistical report. Enabling this setting displays the **Read/Write Stream DMA** command in the Read/Write page.

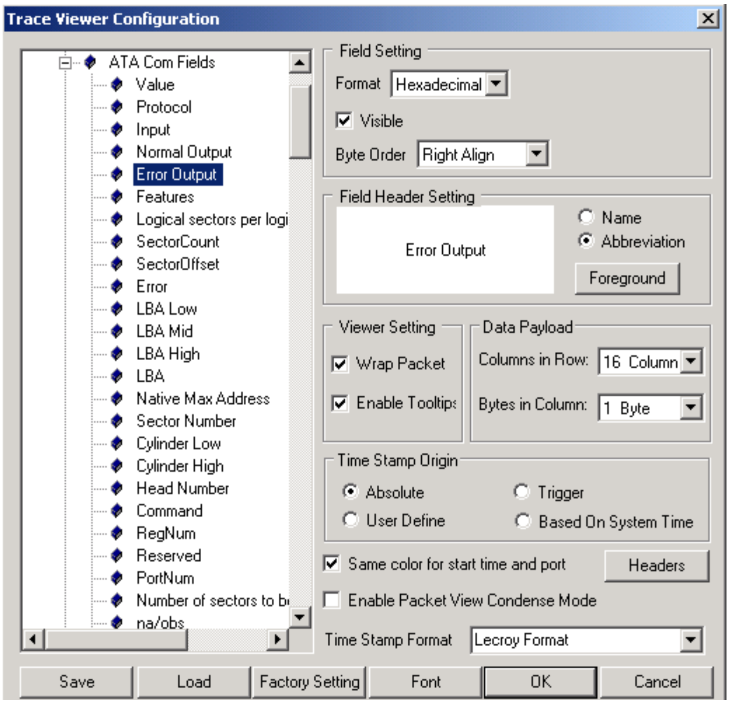
Show Quick View Warning: The Quick View Warning pops up when attempting to close a trace that has not yet been saved, and is only shown in Quick View "mode". This checkbox allows to turn off this popup.

LBA mode: Checking this box enables LBA mode for ATA decoding.

CHS mode: Checking this box enables CHS mode for ATA decoding.

According to LBA mode in ATA command: Checking this box enables decoding according to LBA mode in ATA command for ATA decoding.

Configuration: Clicking the **Configuration** button in the **Trace Viewer** tab in **Preferences** displays the Trace Viewer Configuration dialog (see Figure 3.179 on page 255).

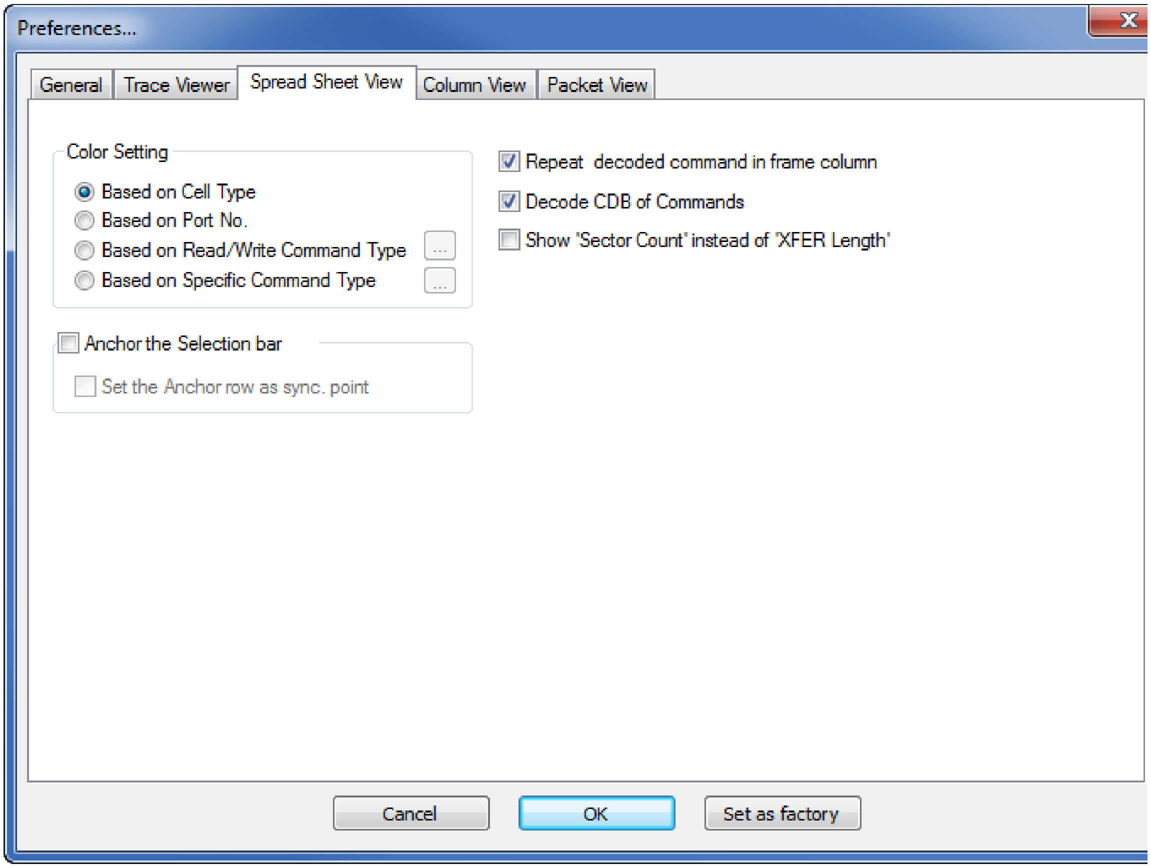

Trace Viewer Configuration
ATA Com Fields
Value
Protocol
Input
Normal Output
Error Output
Features
Logical sectors per logi
SectorCount
SectorOffset
Error
LBA Low
LBA Mid
LBA High
LBA
Native Max Address
Sector Number
Cylinder Low
Cylinder High
Head Number
Command
RegNum
Reserved
PortNum
Number of sectors to b
na/obs
Field Setting
Field Header Setting
Foreground
Viewer Setting
Data Payload
Time Stamp Origin
Headers
Save
Load
Factory Setting
Font
OK
Cancel

Format: Hexadecimal
☑ Visible
Byte Order: Right Align
Error Output
○ Name
● Abbreviation
☑ Wrap Packet
☑ Enable Tooltips
Columns in Row: 16 Column
Bytes in Column: 1 Byte
● Absolute
○ Trigger
○ User Define
○ Based On System Time
☑ Same color for start time and port
☐ Enable Packet View Condense Mode
Time Stamp Format: Lecroy Format

Figure 3.179: Preferences Dialog Trace Viewer Configuration Tab

Select a view in the left pane and set the trace viewer display options in the right pane.

3.18.3 Spread Sheet View Tab



Color Setting

● Based on Cell Type
○ Based on Port No.
○ Based on Read/Write Command Type
○ Based on Specific Command Type

☐ Anchor the Selection bar

☐ Set the Anchor row as sync. point

☑ Repeat decoded command in frame column

☑ Decode CDB of Commands

☐ Show 'Sector Count' instead of 'XFER Length'

Figure 3.180: Preferences Dialog Spread Sheet View Tab

Color Setting

Based on Cell Type: Each column has its own color.

Based on Port No.: Data of each row are shown based on the specified color for its port. You can set the color of ports in the Viewer settings.

Based on Read/Write Command Type: You can specify a color for Read commands, another color for Write commands, and other color for other commands. The software shows each row based on the command type: Read, Write, or others.

Based on Specific Command Type: You can specify a color for each command. The software applies the setting on the Command column.

Anchor the Selection Bar

You can anchor the selection bar of the Spreadsheet View.

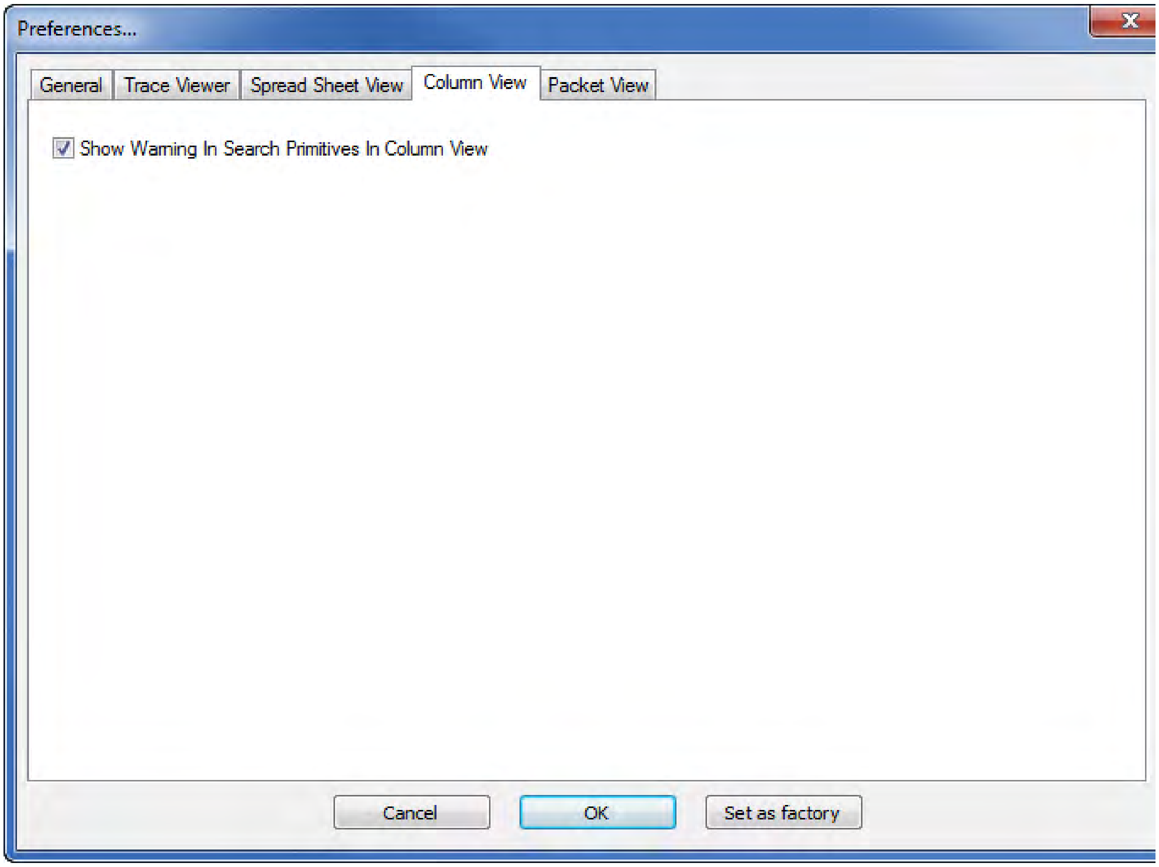
Set the Anchor row as sync. point: Other views synchronize based on the contents of the anchor row.Other

Repeat decoded command in frame column: The spreadsheet shows the name of the command in front of all frames in the Command column. Otherwise, it will show the name of the command only in front of the SSP command frame.

Decode CDB of Commands: The spreadsheet shows name of command in command column, otherwise shows CDB of command in command column.

Show 'Sector Count' instead of 'Xfer Length' (SATA only): Display sector count.

3.18.4 Column View Tab

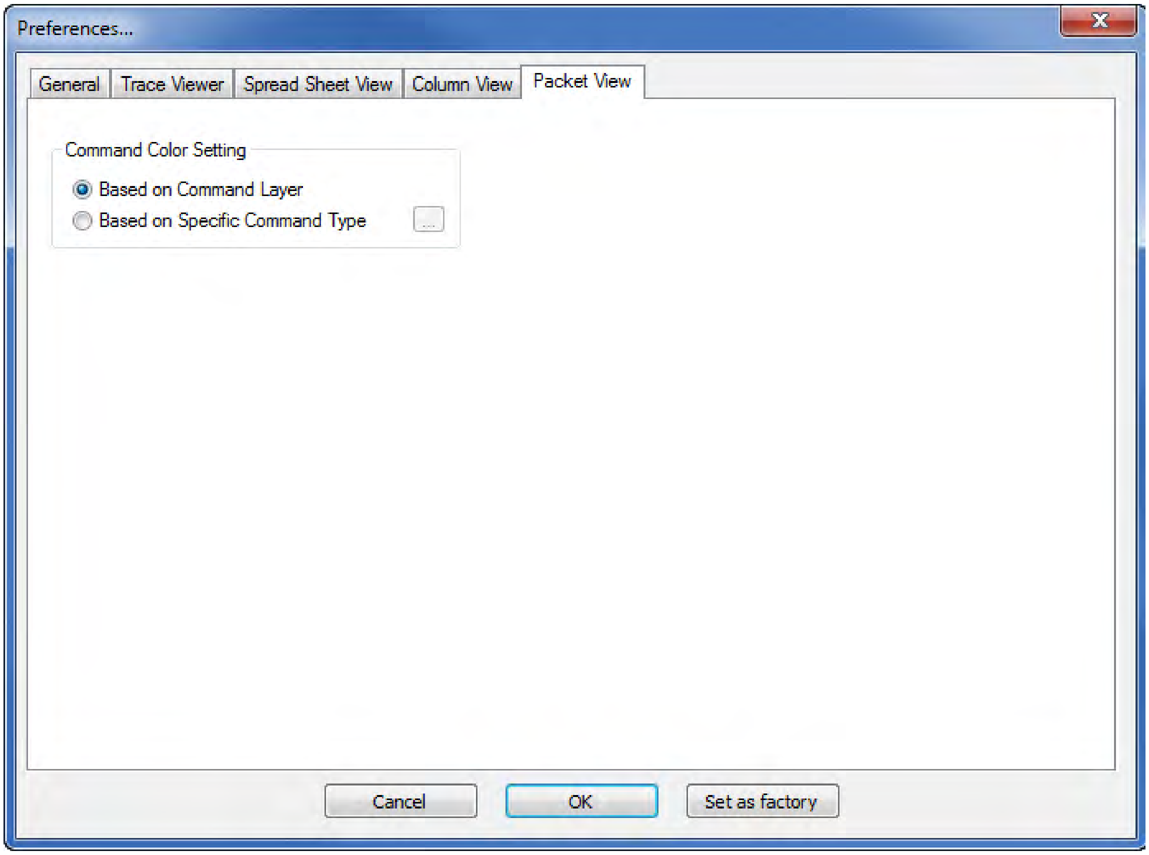


☑ Show Warning In Search Primitives In Column View

Figure 3.181: Preferences Dialog Column View Tab

Show Warning in Search Primitive In Column View: If searching in Column View takes a long time, the software asks if you want to continue search. Otherwise, the software continues searching with no pause.

3.18.5 Packet View Tab



Command Color Setting

● Based on Command Layer

○ Based on Specific Command Type

Figure 3.182: Preferences Dialog Packet View Tab

Based on Command Layer: You can specify a color for the Command Layer. The software shows each row based on the command layer.

Based on Specific Command Type: You can specify a color for each command. The software applies the setting on the Command column.

3.18.6 Sampling Memory Usage Optimization

The Preferences dialog has a Sampling Memory Usage Optimization option in the **Trace Viewer** tab. This Memory Assignment (MA) feature optimizes sampling memory utilization.

If the Sampling Memory Usage Optimization Option is Checked

The system tries to use empty space in all memory banks to prevent any memory bank from filling completely. Each physical link is not necessarily assigned to a specific memory bank. The system can capture more sample data than if the MA option is unchecked, and sample file size is closer to the user-defined Sampling Memory Size.

Memory Assignment efficiency varies with Port Configuration and Trigger Position:

- **Triggering**: Memory Assignment only starts after the trigger point. During pre-trigger, each physical link is always assigned to a specific memory bank. Post-trigger, the system can try to use empty space in all memory banks, if you check the MA option. Therefore, Memory Assignment efficiency is maximum when Trigger Position is set to 0% (snap-shot trigger) and is minimum when Trigger Position is set to 99% or when there is no triggering (you stop recording manually).

- ☐ **MUX**: When MUX is enabled, each segment has four memory banks, limiting Memory Assignment somewhat.

Here are examples of different Port Configurations and Trigger Positions:

- **One port configuration (A - - -):** Sample size is user-specified sample size.
- **Two port configuration (AA - -)**: Ports 1 and 2 are on the same FPGA, so Memory Assignment has an effect. If you use snapshot triggering, the sample size is near specified size.
- **Two port configuration (AA - -):** If you use manual stop, Memory Assignment has no effect. Sample size depends on port traffic loads.
- **Two port configuration (AA - -)**: If trigger is set at 50%, and there is enough data to fill pre-trigger, Memory Assignment has an effect. Sample size is typically near specified size.
- **Two port configuration (AA - -)**: If trigger is set at 50%, but there is not enough data to fill pre-trigger, Memory Assignment has an effect. Sample size is typically more than half specified size, with size determined by the amount of data captured before trigger.

Note: Checking this option does not affect the sample. It only allows larger sample sizes.

Note: If traffic is balanced on ports, sample size is the same whether you check or uncheck the Sampling Memory Usage Optimization option.

Note: Memory Assignment depends on traffic load distribution at the time when the system tries to re-assign physical links to memory banks. Therefore, if you repeat a capture with the same Sampling Memory Size and Segment Number parameters, the resulting sample size may not be the same. However, if traffic load distribution is similar, sample size will be similar.

Note: The buffer status indicator shows buffer by FPGA, not by port.

If the Sampling Memory Usage Optimization Option is Not Checked

Each physical link (or logical link if MUX is enabled) is assigned to a specific memory space (memory bank), depending on the Sampling Memory Size and Segment Number parameters.

Important: If **any** physical link fills its memory bank, the recording process stops. Other memory banks will typically be less than full (and can be empty). The sample file might be smaller than the user-defined Sampling Memory Size. You might even think that the Analyzer malfunctioned.

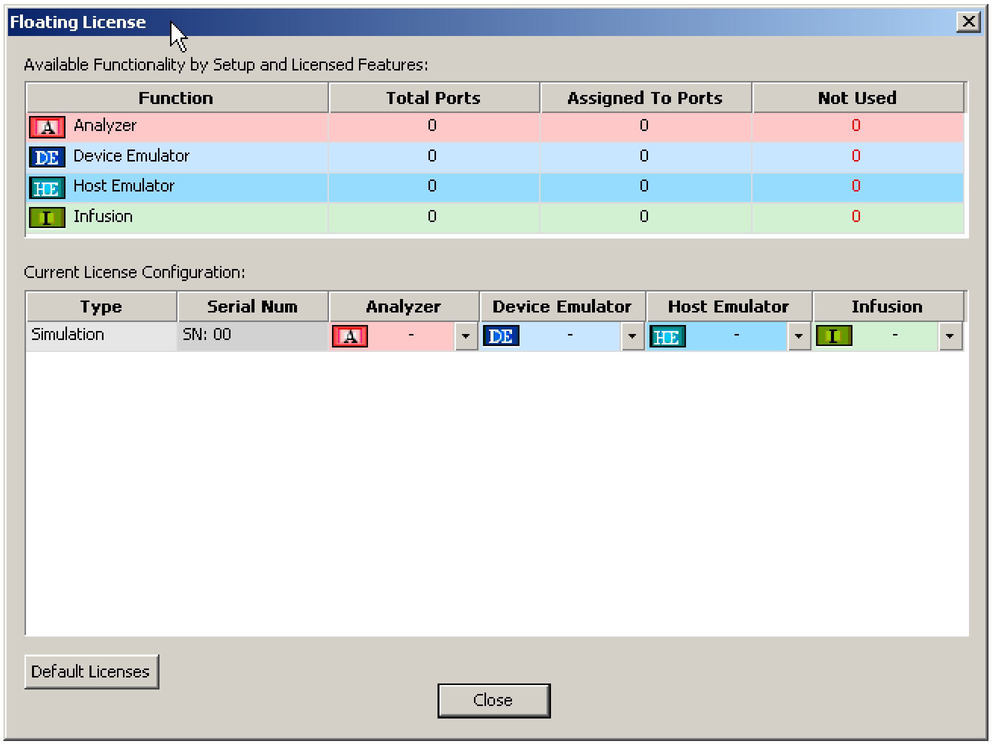
3.19 Floating License

Note: License Manager is only available when in Cascading mode. For example, if one unit is licensed only for JJJJ and a second unit is licensed only for AAAA, cascading the two units and using the License Manager allows each unit to do JJAA.

To manage the license, select **Setup > Manage Setup Licenses**.

The Floating License dialog displays the available functionality by Function, Total Ports, Assigned To ports, and Not Used. It also displays the Current License Configuration by License Type, Serial Number, Analyzer, Device Emulator, Host Emulator, and InFusion.

Note: Sierra M122 currently does not support Device Emulator, Host Emulator, and InFusion.



Available Functionality by Setup and Licensed Features:

Function	Total Ports	Assigned To Ports	Not Used
A Analyzer	0	0	0
DE Device Emulator	0	0	0
HE Host Emulator	0	0	0
I Infusion	0	0	0

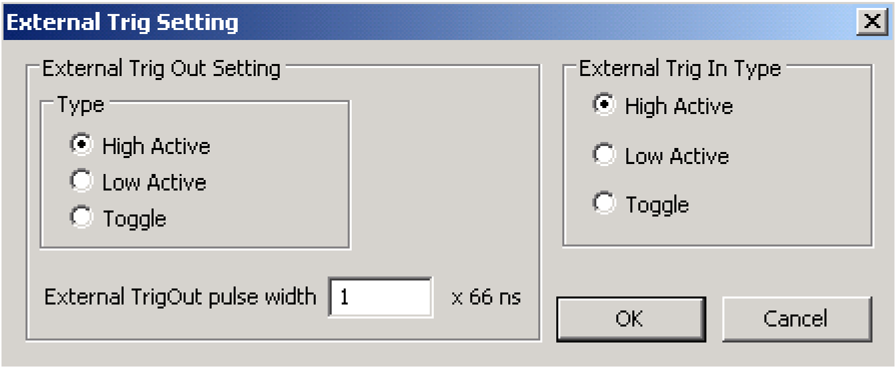
Current License Configuration:

Type	Serial Num	Analyzer	Device Emulator	Host Emulator	Infusion
Simulation	SN: 00	A -	DE -	HE -	I -

Figure 3.183: Floating License Dialog

3.20 External Trig Setting

The External Trig Setting dialog displays the External Trig Out Setting and External Trig In Setting as High Active, Low Active, or Toggle.



External Trig Out Setting — Type: ● High Active ○ Low Active ○ Toggle

External TrigOut pulse width 1 x 66 ns

External Trig In Type: ● High Active ○ Low Active ○ Toggle

Figure 3.184: External Trigger Setting Dialog

To display the External Trig Setting dialog, select **Setup > External Trig Setting**.

External Trig Out Setting
The Analyzer can send a Low or High external signal anytime a trigger occurs. Select the External Trig Out Setting: High Active, Low Active, or Toggle from High to Low or Low to High once (3.3 V output).

Enter the External TrigOut pulse width.

Note: The External TrigOut pulse width field supports increments of 16 ns, starting from 64 ns and up to 1024 ns.

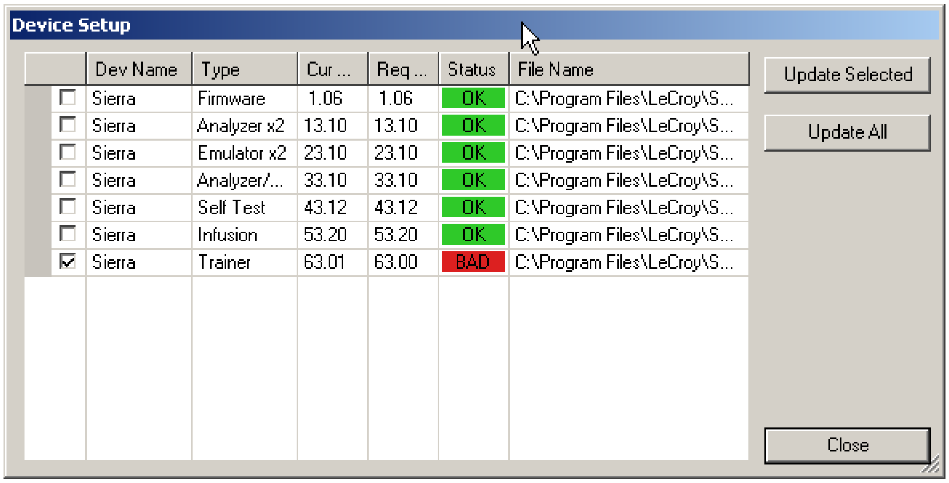
External Trig In Setting
An external Low or High input signal can cause triggering. Select the
External Trig In Setting: High Active, Low Active, or Toggle from High to Low or Low to High once (3.3 V output).

Note: The nominal External Trigger voltage is 0.818 volts. Trigger In can work with 1 volt to 5 volts input voltage.

3.21 Update Device

The Update Device command allows you to update a Sierra M122 Analyzer or CATC-Sync expansion card whose current version is incorrect.

1. Click **Setup > Update Device** to display the Device Setup dialog.



	Dev Name	Type	Cur ...	Req ...	Status	File Name
☐	Sierra	Firmware	1.06	1.06	OK	C:\Program Files\LeCroy\S...
☐	Sierra	Analyzer x2	13.10	13.10	OK	C:\Program Files\LeCroy\S...
☐	Sierra	Emulator x2	23.10	23.10	OK	C:\Program Files\LeCroy\S...
☐	Sierra	Analyzer/...	33.10	33.10	OK	C:\Program Files\LeCroy\S...
☐	Sierra	Self Test	43.12	43.12	OK	C:\Program Files\LeCroy\S...
☐	Sierra	Infusion	53.20	53.20	OK	C:\Program Files\LeCroy\S...
☑	Sierra	Trainer	63.01	63.00	BAD	C:\Program Files\LeCroy\S...

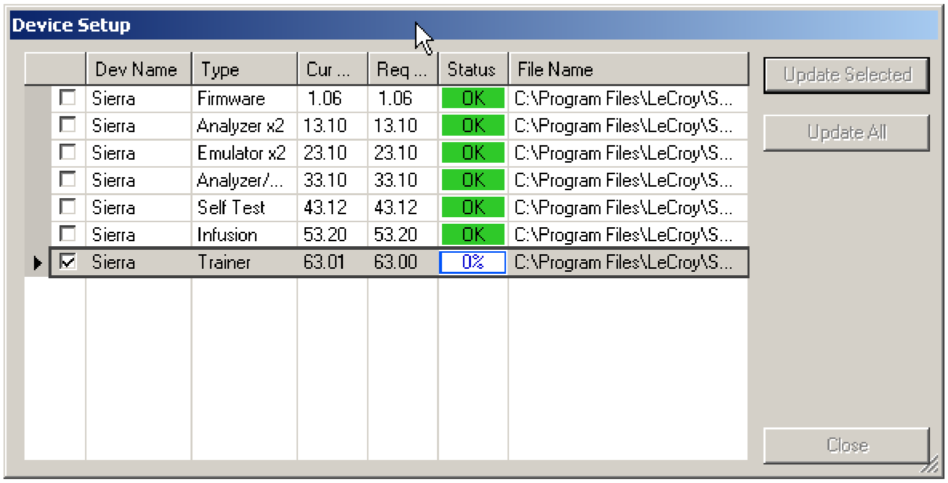
Figure 3.185: Device Setup Dialog with BAD Device Status

Devices whose version is correct have an OK status.
A device whose version is incorrect has a BAD status.

Note: You can click the ellipses (...) at the end of a file path and name to display an Open dialog, in which you can browse for files.

---

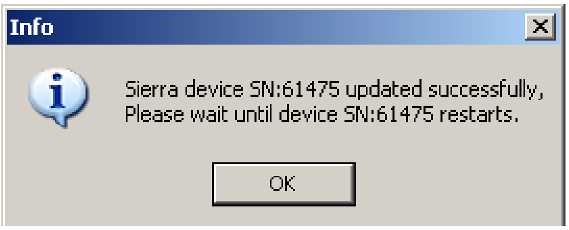
2. Click the checkbox to the left of a device with BAD status, then click **Update Selected** to begin the process that will make the Analyzer version correct (see figure on next page).



	Dev Name	Type	Cur ...	Req ...	Status	File Name
☐	Sierra	Firmware	1.06	1.06	OK	C:\Program Files\LeCroy\S...
☐	Sierra	Analyzer x2	13.10	13.10	OK	C:\Program Files\LeCroy\S...
☐	Sierra	Emulator x2	23.10	23.10	OK	C:\Program Files\LeCroy\S...
☐	Sierra	Analyzer/...	33.10	33.10	OK	C:\Program Files\LeCroy\S...
☐	Sierra	Self Test	43.12	43.12	OK	C:\Program Files\LeCroy\S...
☐	Sierra	Infusion	53.20	53.20	OK	C:\Program Files\LeCroy\S...
☑	Sierra	Trainer	63.01	63.00	0%	C:\Program Files\LeCroy\S...

Figure 3.186: Device Setup Dialog Beginning to Update Status of a Device

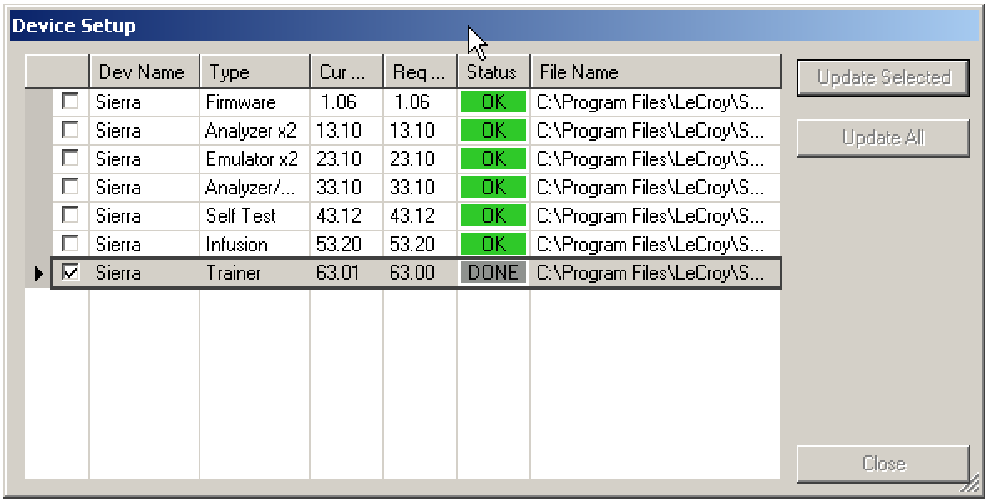
After the update, the device must restart.



Sierra device SN:61475 updated successfully,
Please wait until device SN:61475 restarts.

Figure 3.187: Info Dialog

Then the update is complete.



		Dev Name	Type	Cur ...	Req ...	Status	File Name
	☐	Sierra	Firmware	1.06	1.06	OK	C:\Program Files\LeCroy\S...
	☐	Sierra	Analyzer x2	13.10	13.10	OK	C:\Program Files\LeCroy\S...
	☐	Sierra	Emulator x2	23.10	23.10	OK	C:\Program Files\LeCroy\S...
	☐	Sierra	Analyzer/...	33.10	33.10	OK	C:\Program Files\LeCroy\S...
	☐	Sierra	Self Test	43.12	43.12	OK	C:\Program Files\LeCroy\S...
	☐	Sierra	Infusion	53.20	53.20	OK	C:\Program Files\LeCroy\S...
▶	☑	Sierra	Trainer	63.01	63.00	DONE	C:\Program Files\LeCroy\S...

Figure 3.188: Device Setup Dialog with DONE Device Status

3.22 User-Defined Decoding

User-defined decoding allows you to create a definition file to interpret commands and frames that are not in the standard set recognized by the software.

Select **Setup > User Defined Decoding** to open the User Defined Decoding dialog. See Figure 3.189.

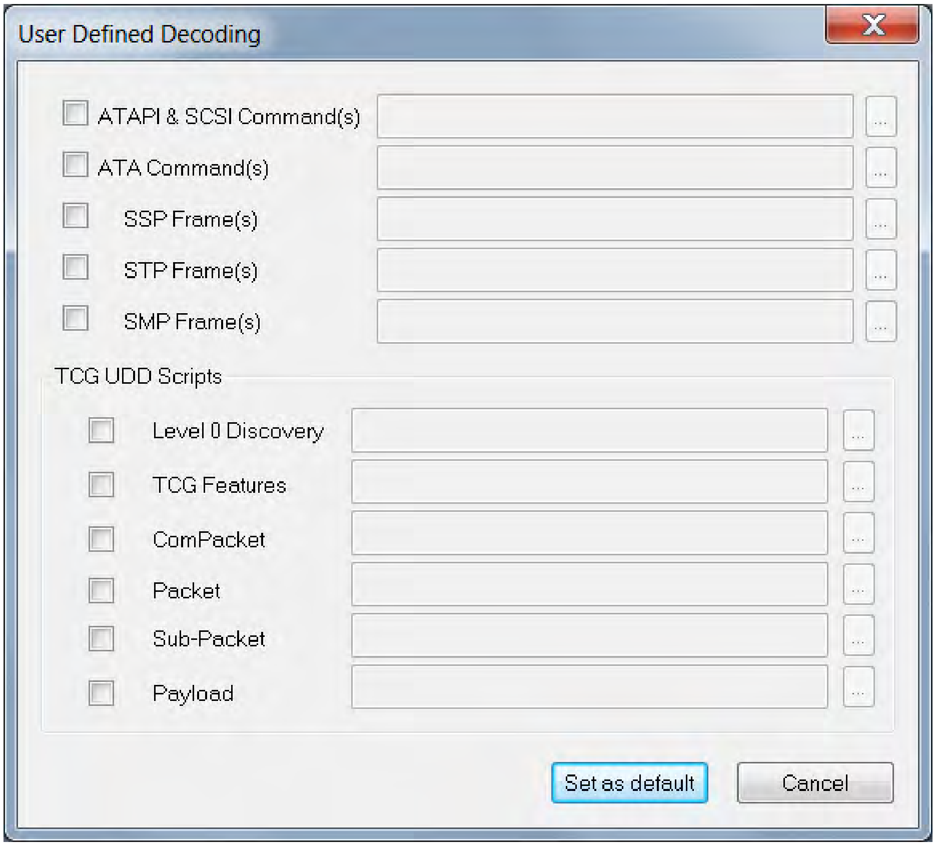

User Defined Decoding
☐ ATAPI & SCSI Command(s)
☐ ATA Command(s)
☐ SSP Frame(s)
☐ STP Frame(s)
☐ SMP Frame(s)
TCG UDD Scripts
☐ Level 0 Discovery
☐ TCG Features
☐ ComPacket
☐ Packet
☐ Sub-Packet
☐ Payload
Set as default
Cancel

Figure 3.189: SAS/SATA: User Defined Decoding.

SAS adds SCSI Commands, SSP Frames, and SMP Frames.

Select one of the script types and click on the “...” tab. See Figure 3.190 on page 265.

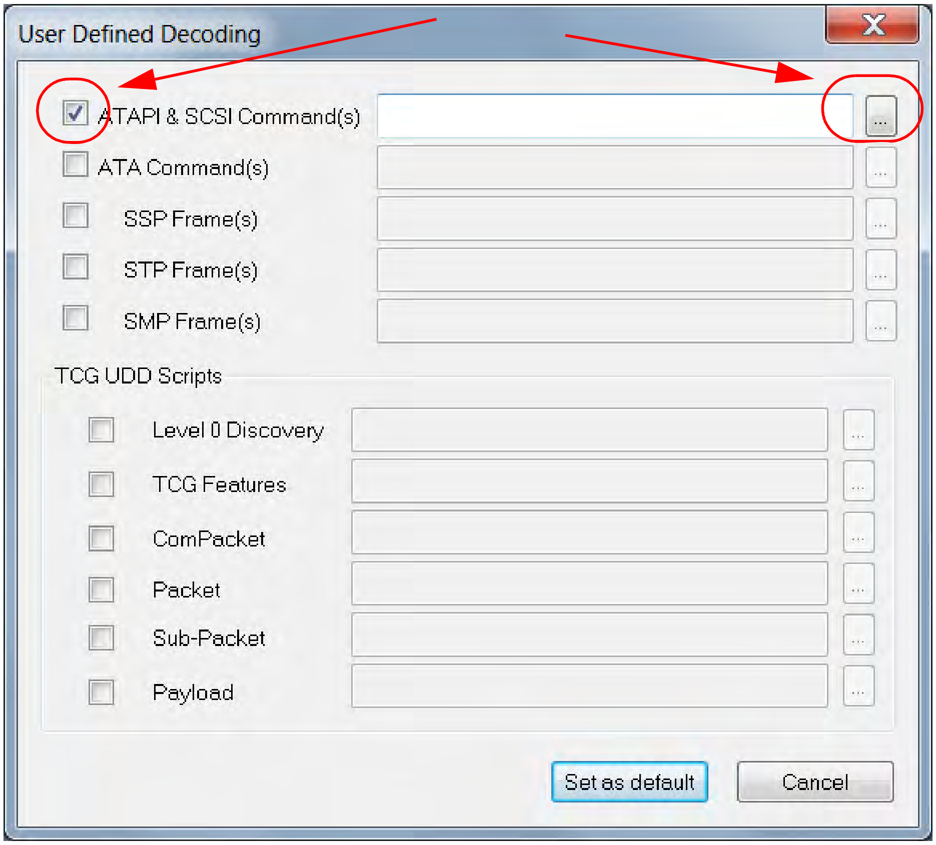
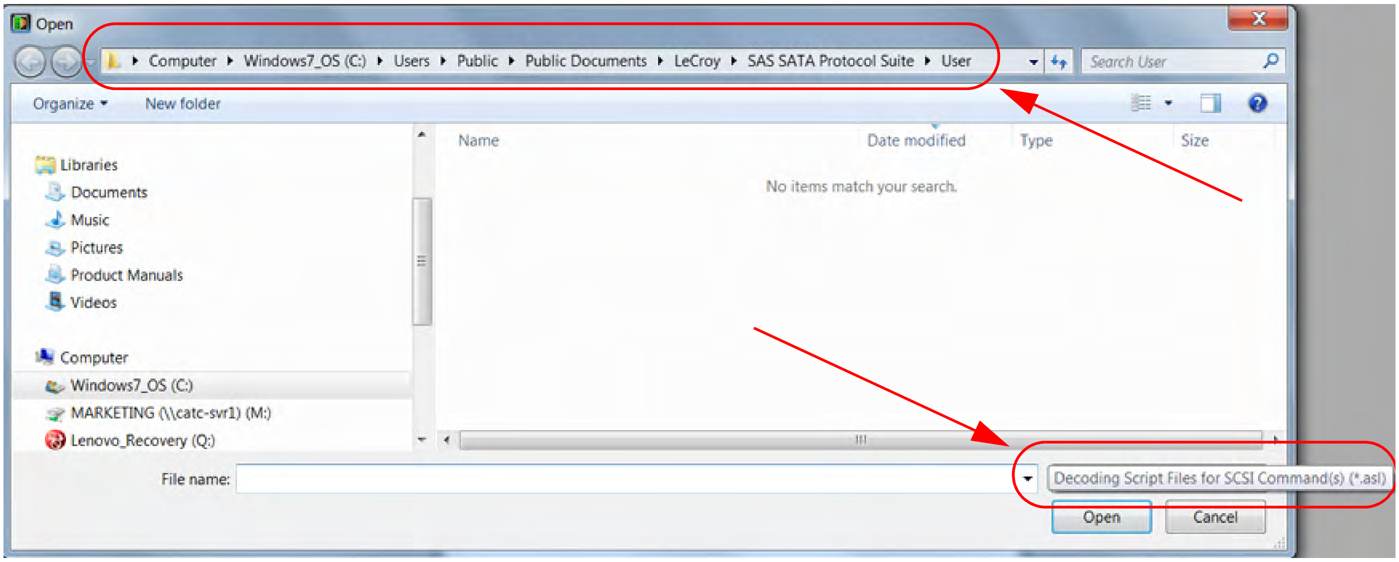

User Defined Decoding
☑ ATAPI & SCSI Command(s) ...
☐ ATA Command(s) ...
☐ SSP Frame(s) ...
☐ STP Frame(s) ...
☐ SMP Frame(s) ...
TCG UDD Scripts
☐ Level 0 Discovery ...
☐ TCG Features ...
☐ ComPacket ...
☐ Packet ...
☐ Sub-Packet ...
☐ Payload ...
Set as default
Cancel

Figure 3.190: Select a Script Type

This will take you to the location of the stored script type. See Figure 3.191.


Open
Computer ▸ Windows7_OS (C:) ▸ Users ▸ Public ▸ Public Documents ▸ LeCroy ▸ SAS SATA Protocol Suite ▸ User
Search User
Organize
New folder
Libraries
Documents
Music
Pictures
Product Manuals
Videos
Computer
Windows7_OS (C:)
MARKETING (\\catc-svr1) (M:)
Lenovo_Recovery (Q:)
Name
Date modified
Type
Size
File name:
Open
Cancel

No items match your search.

Decoding Script Files for SCSI Command(s) (*.asl)

Figure 3.191: Path to Stored User Defined Scripts

Choose an appropriate script file and click **Open**.

3.23 Help Menu

3.23.1 Tell Teledyne LeCroy

Report a problem to Teledyne LeCroy Support via e-mail. This requires that an e-mail client be installed and configured on the host machine.

3.23.2 Help Topics

Displays on-line help. You can also select F1.

3.23.3 VSE Help Topics

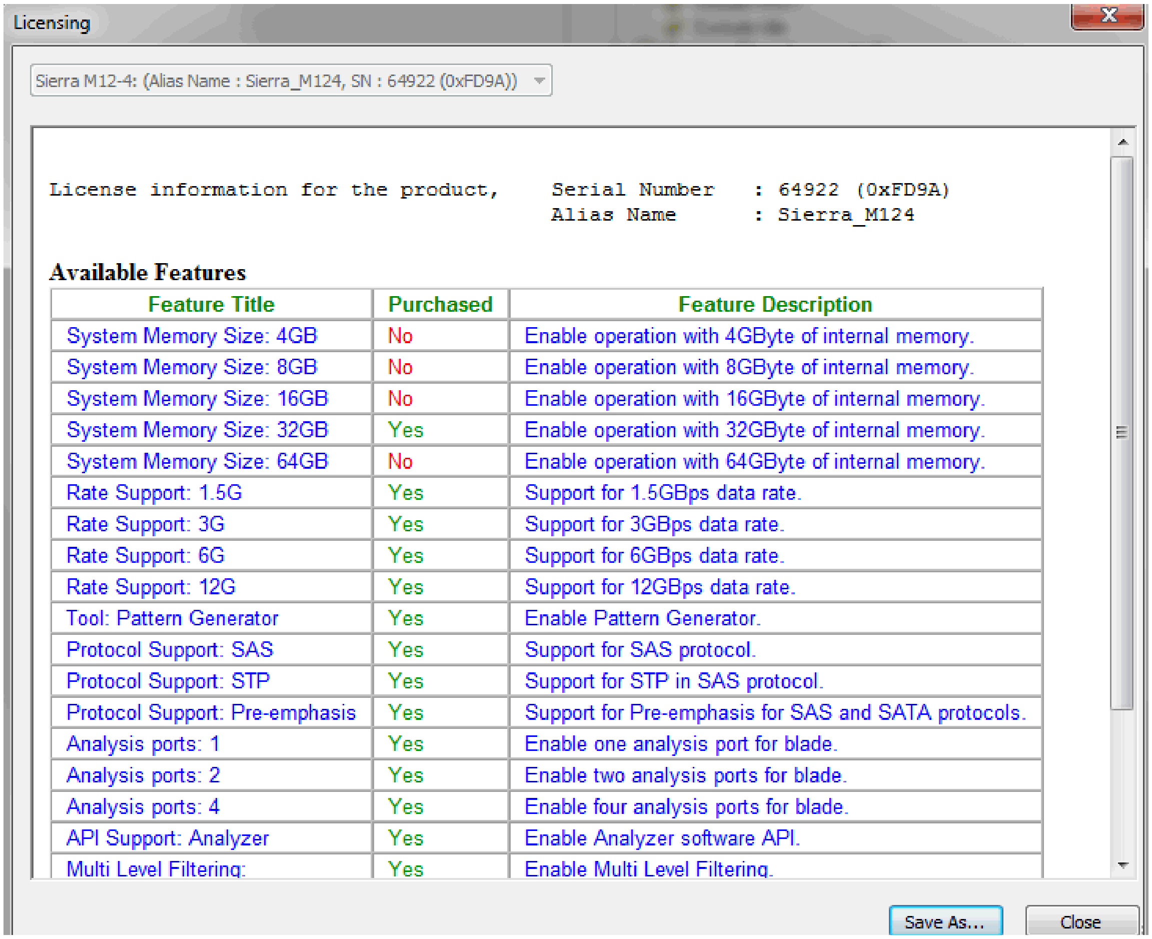
Displays VSE on-line help. You can also select F1.

3.23.4 Update License

A current license agreement with Teledyne LeCroy entitles the Analyzer owner to continued technical support and access to software updates as they are published on the Teledyne LeCroy website. When you obtain a license key, from the Help menu select Update License to display the Select License Key File dialog box. Enter the path and filename for the license key, or browse to the directory that contains the license key and select the *.lic file. Click Open.

3.23.5 Display License Information

Opens the license information dialog to display a list of named features supported by the current software version (see Figure 3.192 on page 267). Named features that are not enabled on your system are indicated by No in the Purchased column. Whether or not named features are enabled depends on the license key stored in your analyzer. If you try to use a feature for which you do not yet have a license, the program displays the License Protection Message. To use the feature, you must purchase a license.



Licensing
Sierra M12-4: (Alias Name : Sierra_M124, SN : 64922 (0xFD9A))
Save As...
Close

```
License information for the product,    Serial Number    : 64922 (0xFD9A)
                                          Alias Name       : Sierra_M124
```

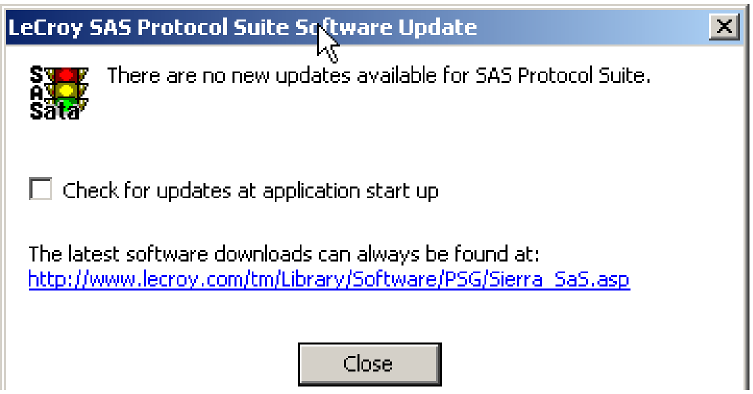
Available Features

Feature Title	Purchased	Feature Description
System Memory Size: 4GB	No	Enable operation with 4GByte of internal memory.
System Memory Size: 8GB	No	Enable operation with 8GByte of internal memory.
System Memory Size: 16GB	No	Enable operation with 16GByte of internal memory.
System Memory Size: 32GB	Yes	Enable operation with 32GByte of internal memory.
System Memory Size: 64GB	No	Enable operation with 64GByte of internal memory.
Rate Support: 1.5G	Yes	Support for 1.5GBps data rate.
Rate Support: 3G	Yes	Support for 3GBps data rate.
Rate Support: 6G	Yes	Support for 6GBps data rate.
Rate Support: 12G	Yes	Support for 12GBps data rate.
Tool: Pattern Generator	Yes	Enable Pattern Generator.
Protocol Support: SAS	Yes	Support for SAS protocol.
Protocol Support: STP	Yes	Support for STP in SAS protocol.
Protocol Support: Pre-emphasis	Yes	Support for Pre-emphasis for SAS and SATA protocols.
Analysis ports: 1	Yes	Enable one analysis port for blade.
Analysis ports: 2	Yes	Enable two analysis ports for blade.
Analysis ports: 4	Yes	Enable four analysis ports for blade.
API Support: Analyzer	Yes	Enable Analyzer software API.
Multi Level Filtering:	Yes	Enable Multi Level Filtering.

Figure 3.192: Licensing Dialog

3.23.6 Check for Updates

Check whether a new software version is available. If so, you can download from the Teledyne LeCroy web site.
You can select to Check for updates at application startup.



There are no new updates available for SAS Protocol Suite.

☐ Check for updates at application start up

The latest software downloads can always be found at:
http://www.lecroy.com/tm/Library/Software/PSG/Sierra_SaS.asp

Figure 3.193: Check for Updates

3.23.7 About

Displays version information.

3.24 Find DUT

Saving device information allows you to import the specific device information into the Target/Device emulator.

The Find DUT utility obtains all vendor-specific information and detailed device parameters.

This feature only works in "SAS address" mode. It finds SAS addresses only and works up to one expander level.

Find device finds any devices that are attached to any port.

Note: Software only finds SAS devices and SATA devices not ATAPI devices.

Select **Setup** on the main menu bar and choose **Find DUT**.

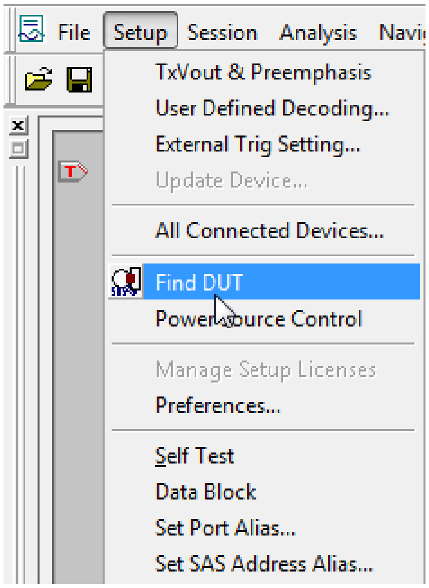
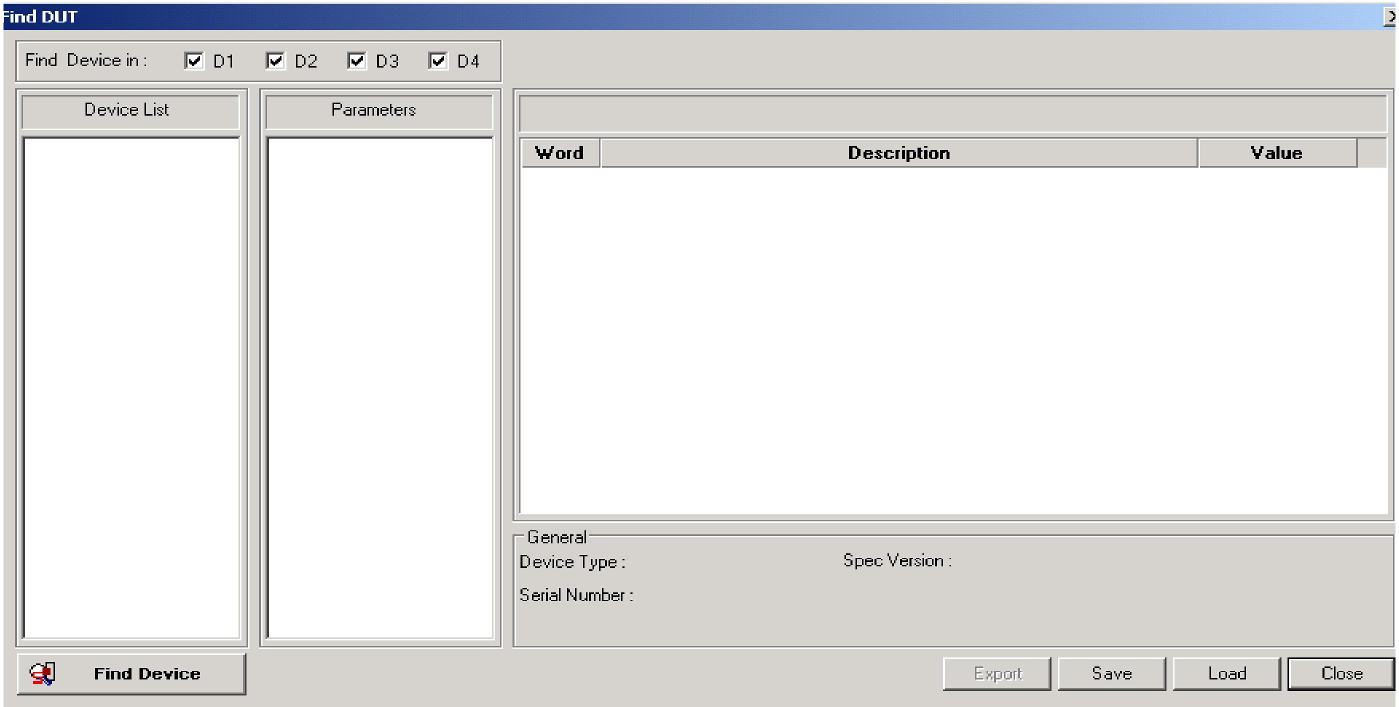

File
Setup
Session
Analysis
Navi
TxVout & Preemphasis
User Defined Decoding...
External Trig Setting...
Update Device...
All Connected Devices...
Find DUT
Power Source Control
Manage Setup Licenses
Preferences...
Self Test
Data Block
Set Port Alias...
Set SAS Address Alias...

Figure 3.194: Find DUT

The Find DUT dialog displays (see Figure 3.195 on page 270).


Find DUT
Device List
Parameters
Word
Description
Value
General
Export
Save
Load
Close
Find Device

Find Device in : ☑ D1 ☑ D2 ☑ D3 ☑ D4

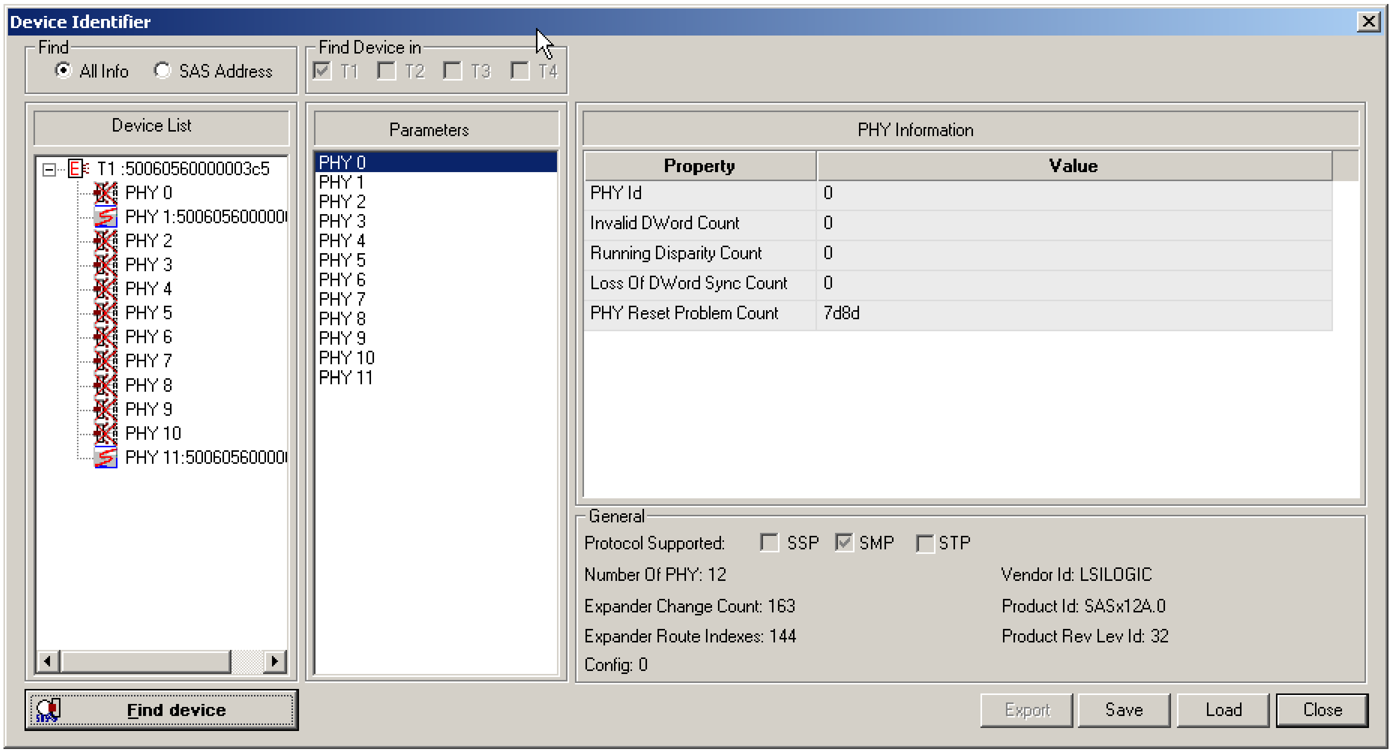
Device Type :

Spec Version :

Serial Number :

Figure 3.195: Find DUT Dialog

Click the **Find Device** button to search for connected devices. After a brief period, the dialog displays all device information.


Device Identifier
Find
Find Device in
Device List
Parameters
PHY Information
General
Find device
Export
Save
Load
Close

Find: ● All Info ○ SAS Address

Find Device in: ☑ T1 ☐ T2 ☐ T3 ☐ T4

Device List:

- T1 :50060560000003c5
  - PHY 0
  - PHY 1:500605600000
  - PHY 2
  - PHY 3
  - PHY 4
  - PHY 5
  - PHY 6
  - PHY 7
  - PHY 8
  - PHY 9
  - PHY 10
  - PHY 11:500605600000

Parameters:

- PHY 0
- PHY 1
- PHY 2
- PHY 3
- PHY 4
- PHY 5
- PHY 6
- PHY 7
- PHY 8
- PHY 9
- PHY 10
- PHY 11

Property	Value
PHY Id	0
Invalid DWord Count	0
Running Disparity Count	0
Loss Of DWord Sync Count	0
PHY Reset Problem Count	7d8d

Protocol Supported: ☐ SSP ☑ SMP ☐ STP

Number Of PHY: 12

Vendor Id: LSILOGIC

Expander Change Count: 163

Product Id: SASx12A.0

Expander Route Indexes: 144

Product Rev Lev Id: 32

Config: 0

Figure 3.196: SAS: Identified Devices

Click a device in the Device List to display information about that device.

Aliasing

You can enter a 16-character alias name for a device. In the Device List, right-click the device name and enter an alias after the colon.

The alias name appears in the Device List.

Exporting

You can export a device specification to a text file. Click the **Export** button to open the Export dialog.

3.25 SAS Verification (SAS)

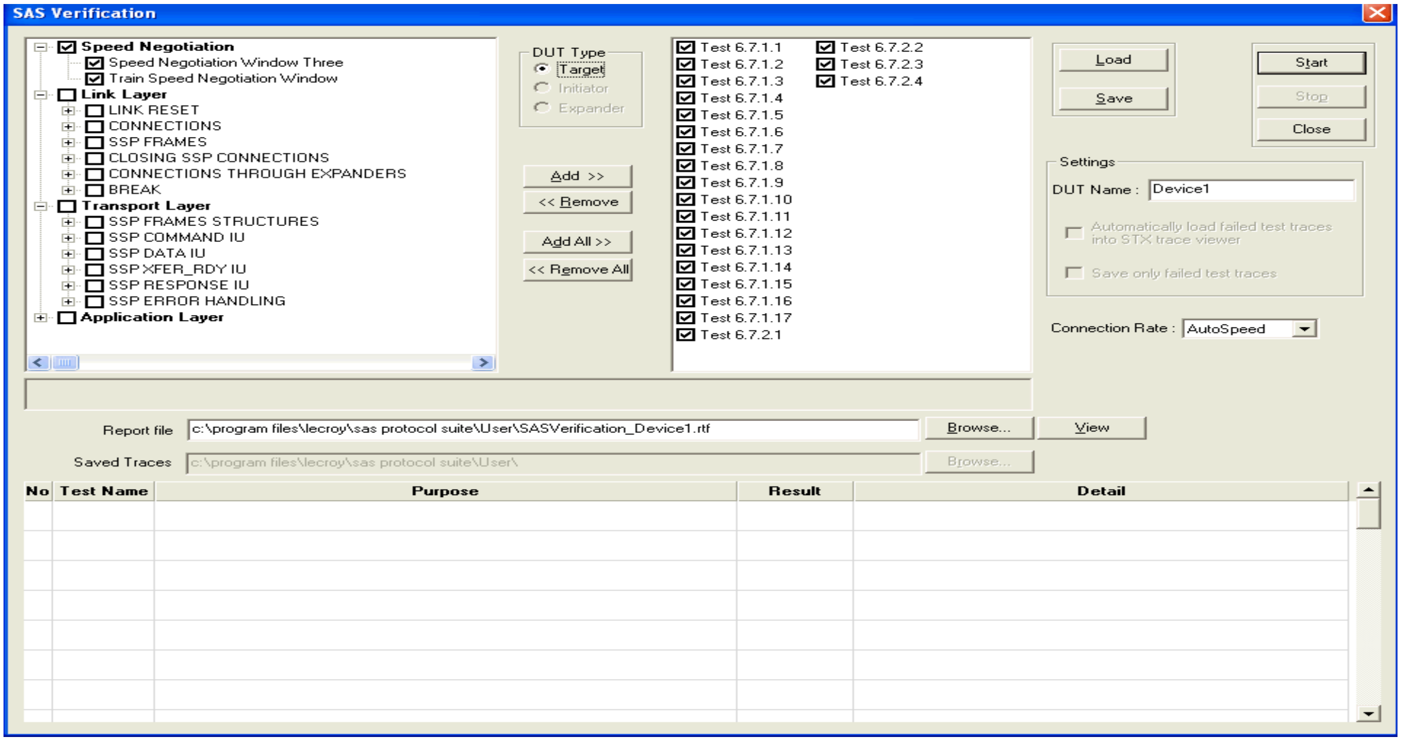
SAS Verification consists of a set of selectable tests to verify compliance with the SAS specification.

Note: Speed Negotiation and all other SAS tests are documented in the *SAS Verification Test Descriptions.pdf*. file in the installed Documents directory.

Note: With the exception of the NACA test, the SAS Verification tests can be run at 12G.

To run a SAS Verification Test:

1. Select **Analysis** on the main toolbar and choose **SAS Verification** to open the SAS Verification dialog (see Figure 3.197 on page 271).


SAS Verification
☑ Speed Negotiation
☑ Speed Negotiation Window Three
☑ Train Speed Negotiation Window
☐ Link Layer
☐ LINK RESET
☐ CONNECTIONS
☐ SSP FRAMES
☐ CLOSING SSP CONNECTIONS
☐ CONNECTIONS THROUGH EXPANDERS
☐ BREAK
☐ Transport Layer
☐ SSP FRAMES STRUCTURES
☐ SSP COMMAND IU
☐ SSP DATA IU
☐ SSP XFER_RDY IU
☐ SSP RESPONSE IU
☐ SSP ERROR HANDLING
☐ Application Layer
DUT Type
● Target
○ Initiator
○ Expander
Add >>
<< Remove
Add All >>
<< Remove All
☑ Test 6.7.1.1
☑ Test 6.7.1.2
☑ Test 6.7.1.3
☑ Test 6.7.1.4
☑ Test 6.7.1.5
☑ Test 6.7.1.6
☑ Test 6.7.1.7
☑ Test 6.7.1.8
☑ Test 6.7.1.9
☑ Test 6.7.1.10
☑ Test 6.7.1.11
☑ Test 6.7.1.12
☑ Test 6.7.1.13
☑ Test 6.7.1.14
☑ Test 6.7.1.15
☑ Test 6.7.1.16
☑ Test 6.7.1.17
☑ Test 6.7.2.1
☑ Test 6.7.2.2
☑ Test 6.7.2.3
☑ Test 6.7.2.4
Load
Save
Start
Stop
Close
Settings
☐ Automatically load failed test traces into STX trace viewer
☐ Save only failed test traces
Browse...
View
Browse...
No
Test Name
Purpose
Result
Detail

DUT Name : Device1

Connection Rate : AutoSpeed

Report file c:\program files\lecroy\sas protocol suite\User\SASVerification_Device1.rtf

Saved Traces c:\program files\lecroy\sas protocol suite\User\

Figure 3.197: SAS Verification Dialog.

- ❑ **Speed Negotiation** has Speed Negotiation Window Three and

Train Speed Negotiation Window.
- ❑ **Link Layer** has Link Reset, Connections, SSP Frames, Closing SSP Connections, Connections through Expanders, and Break.
- ❑ **Transport Layer** has SSP Frames Structures, Command IU, Data IU, XFER_RDY IU, Response IU, and Error Handling.
- ❑ **Application Layer** has SCSI CDB, STP Operations and NACA.

2. Choose the tests in the left pane of the dialog and click the **Add>>** button.
3. Enter a value for **DUT Type**: Target, Initiator, or Expander.
4. Enter a value for the **Number of Runs** to run a particular test more than once.
5. Enter the **DUT Name**.
6. Enter the **Connection Rate** as Autospeed or a value.
7. To view failed test traces in the sample viewer, check the **Automatically load failed test traces into Sierra trace viewer** check box.
8. To save the failed test traces only, check the **Save only failed test traces** check box.
9. Enter a path and file name for **Report file**, or use the default file name and path:

For Windows XP:

```
C:\Program Files\LeCroy\SAS SATA Protocol
Suite\User\SASVerification_Device1.rtf
```

For Windows 7:

```
C:\Users\Public\Documents\LeCroy\SAS SATA Protocol
Suite\User\SASVerification_Device1.rtf
```

10. Enter a path and file name for **Saved Traces**, or use the default folder:

For Windows XP:

```
C:\Program Files\LeCroy\SAS SATA Protocol Suite\User\
```

For Windows 7:

```
C:\Users\Public\Documents\LeCroy\SAS SATA Protocol Suite\User\
```

11. After you select tests, click **Start**.
12. The test runs and, after a brief period, displays the result.
13. To save the current compliance setup for later use, click the **Save** button to open the Save As dialog. Assign a meaningful name to the setup and save it as a ***.cst** compliance file.
14. To run a previously defined setup, click the **Load** button and choose a previously defined setup to run.

Note: For the NACA test, both ports of the SAS device must be connected to two Host Emulation ports, I1 and I2, using two SATA cables.

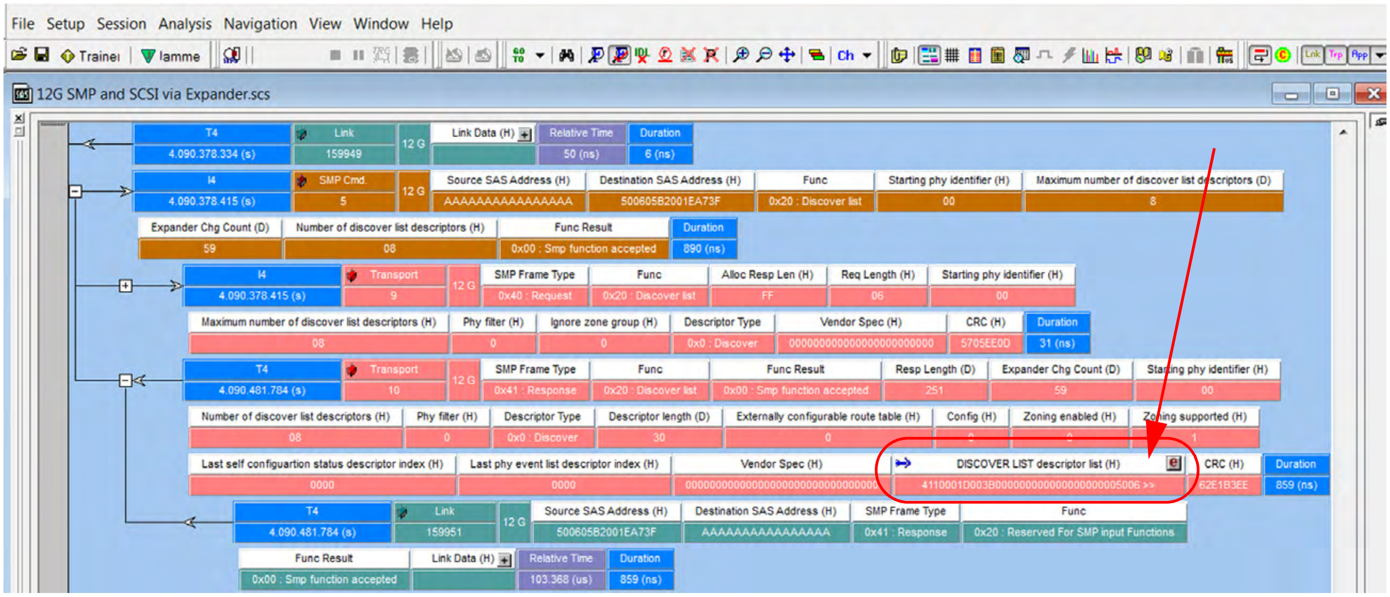
Note: When you are running SAS Verification, you cannot work with Trainer and Emulator while device is connected to D connector and HBA is connected to H connector.

Note: You must use a Power Expansion Card (ACC-EXP-004-x or ACC-EXP-005-X) for SAS Verification. See Using the Power Expansion Card on page 28.

Note: Connecting to an HBA, while running in Emulation/Trainer mode, will impact test results.

3.26 Discover List Descriptor Lists Decode

In a Trace that has Discover List Descriptor Lists, Click on the Discover List descriptor list.



T4	Link		Link Data (H)	Relative Time	Duration
4.090.378.334 (s)	159949	12 G		50 (ns)	6 (ns)

I4	SMP Cmd.		Source SAS Address (H)	Destination SAS Address (H)	Func	Starting phy identifier (H)	Maximum number of discover list descriptors (D)
4.090.378.415 (s)	5	12 G	AAAAAAAAAAAAAAAA	500605B2001EA73F	0x20 : Discover list	00	8

Expander Chg Count (D)	Number of discover list descriptors (H)	Func Result	Duration
59	08	0x00 : Smp function accepted	890 (ns)

I4	Transport		SMP Frame Type	Func	Alloc Resp Len (H)	Req Length (H)	Starting phy identifier (H)
4.090.378.415 (s)	9	12 G	0x40 : Request	0x20 : Discover list	FF	06	00

Maximum number of discover list descriptors (H)	Phy filter (H)	Ignore zone group (H)	Descriptor Type	Vendor Spec (H)	CRC (H)	Duration
08	0	0	0x0 : Discover	000000000000000000000000	5705EE0D	31 (ns)

T4	Transport		SMP Frame Type	Func	Func Result	Resp Length (D)	Expander Chg Count (D)	Starting phy identifier (H)
4.090.481.784 (s)	10	12 G	0x41 : Response	0x20 : Discover list	0x00 : Smp function accepted	251	59	00

Number of discover list descriptors (H)	Phy filter (H)	Descriptor Type	Descriptor length (D)	Externally configurable route table (H)	Config (H)	Zoning enabled (H)	Zoning supported (H)
08	0	0x0 : Discover	30	0	0	0	1

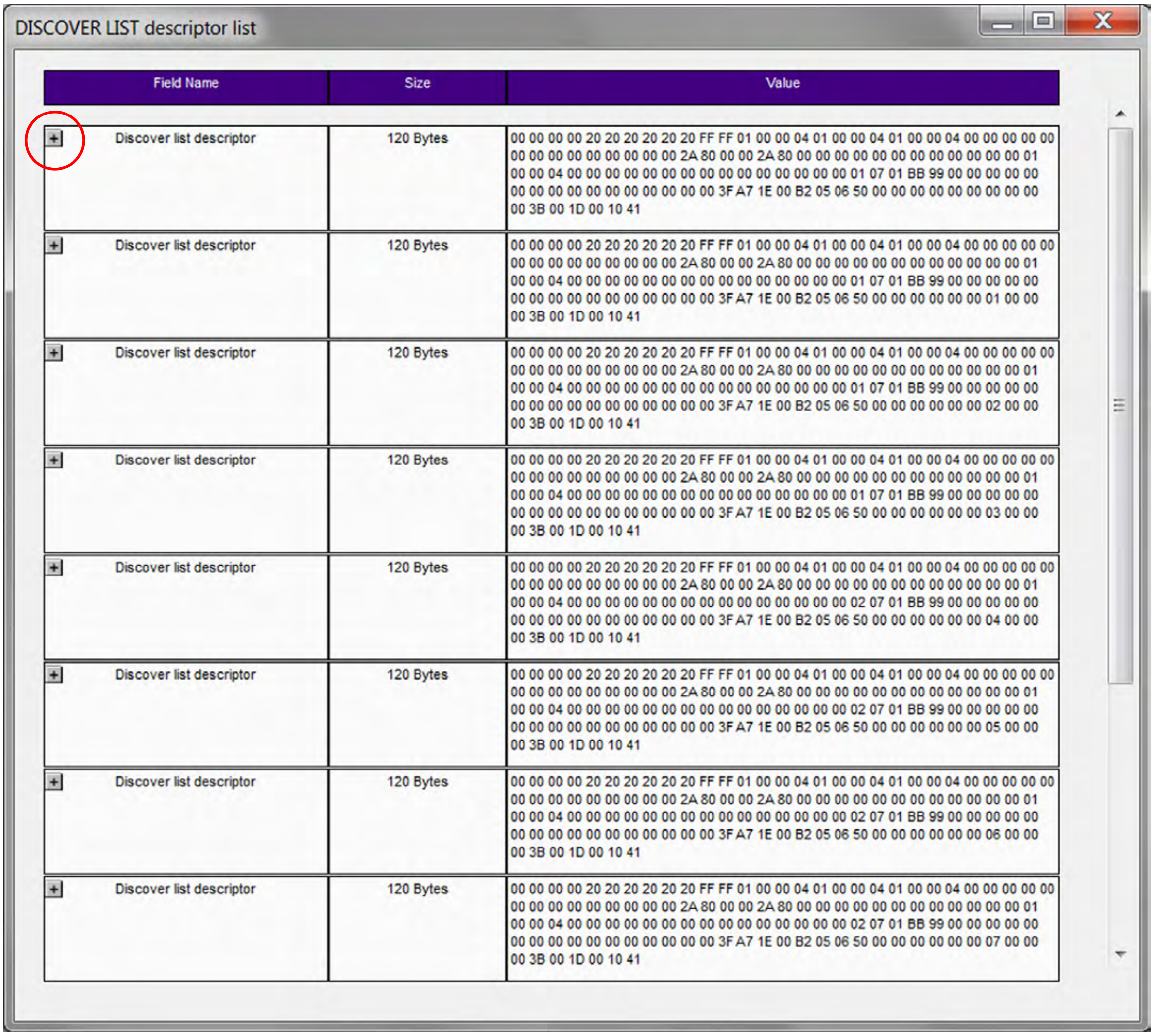
Last self configuartion status descriptor index (H)	Last phy event list descriptor index (H)	Vendor Spec (H)	DISCOVER LIST descriptor list (H)	CRC (H)	Duration
0000	0000	00000000000000000000000000000000	4110001D003B0000000000000000000005006 >>	62E1B3EE	859 (ns)

T4	Link		Source SAS Address (H)	Destination SAS Address (H)	SMP Frame Type	Func
4.090.481.784 (s)	159951	12 G	500605B2001EA73F	AAAAAAAAAAAAAAAA	0x41 : Response	0x20 : Reserved For SMP input Functions

Func Result	Link Data (H)	Relative Time	Duration
0x00 : Smp function accepted		103.368 (us)	859 (ns)

Figure 3.198: Discover List Descriptor Lists

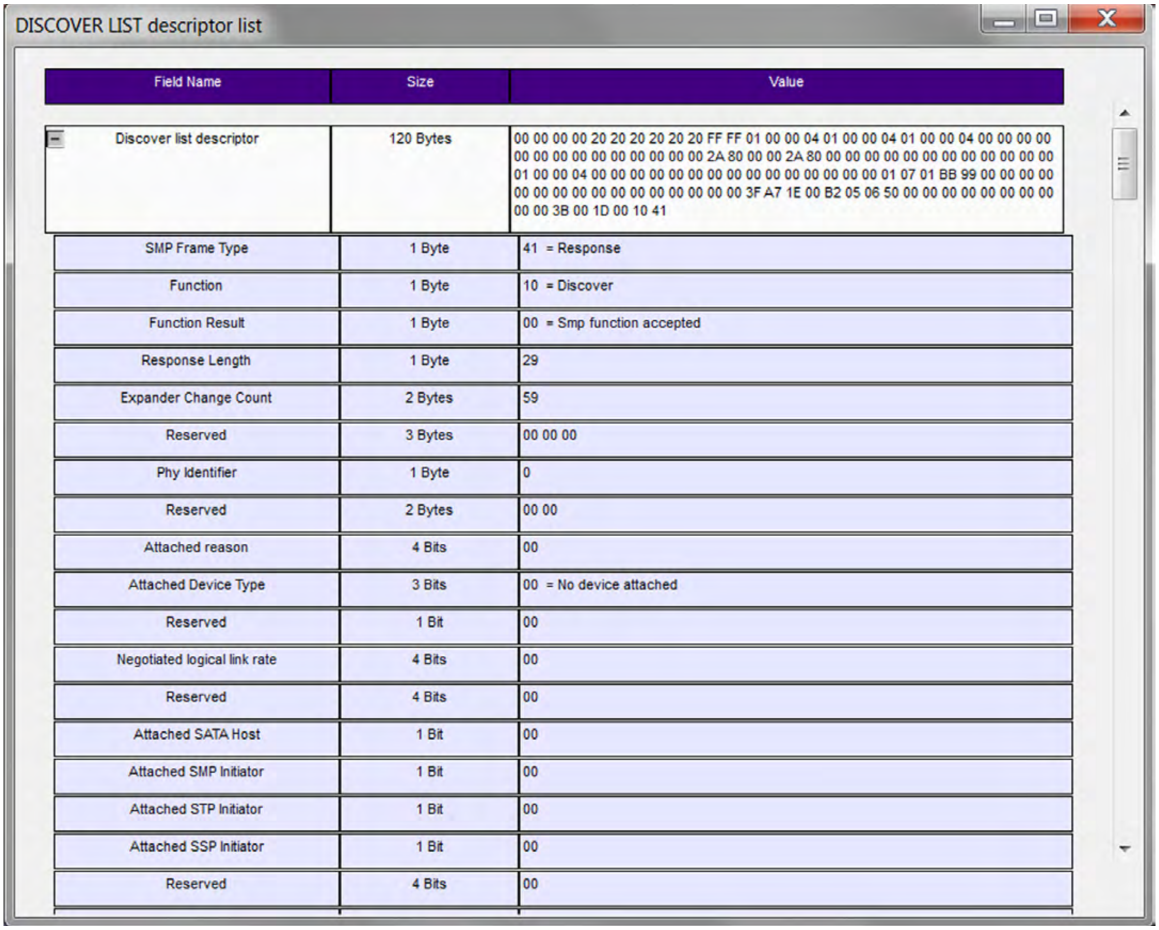
This will bring up the Discover List descriptor list. See Figure 3.199 on page 274.



Field Name	Size	Value
⊞ Discover list descriptor	120 Bytes	00 00 00 00 20 20 20 20 20 20 FF FF 01 00 00 04 01 00 00 04 01 00 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 2A 80 00 00 2A 80 00 00 00 00 00 00 00 00 00 00 00 01 00 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01 07 01 BB 99 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 3F A7 1E 00 B2 05 06 50 00 00 00 00 00 00 00 00 00 3B 00 1D 00 10 41
⊞ Discover list descriptor	120 Bytes	00 00 00 00 20 20 20 20 20 20 FF FF 01 00 00 04 01 00 00 04 01 00 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 2A 80 00 00 2A 80 00 00 00 00 00 00 00 00 00 00 00 01 00 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01 07 01 BB 99 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 3F A7 1E 00 B2 05 06 50 00 00 00 00 00 00 01 00 00 00 3B 00 1D 00 10 41
⊞ Discover list descriptor	120 Bytes	00 00 00 00 20 20 20 20 20 20 FF FF 01 00 00 04 01 00 00 04 01 00 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 2A 80 00 00 2A 80 00 00 00 00 00 00 00 00 00 00 00 01 00 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01 07 01 BB 99 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 3F A7 1E 00 B2 05 06 50 00 00 00 00 00 00 02 00 00 00 3B 00 1D 00 10 41
⊞ Discover list descriptor	120 Bytes	00 00 00 00 20 20 20 20 20 20 FF FF 01 00 00 04 01 00 00 04 01 00 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 2A 80 00 00 2A 80 00 00 00 00 00 00 00 00 00 00 00 01 00 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01 07 01 BB 99 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 3F A7 1E 00 B2 05 06 50 00 00 00 00 00 00 03 00 00 00 3B 00 1D 00 10 41
⊞ Discover list descriptor	120 Bytes	00 00 00 00 20 20 20 20 20 20 FF FF 01 00 00 04 01 00 00 04 01 00 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 2A 80 00 00 2A 80 00 00 00 00 00 00 00 00 00 00 00 01 00 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 02 07 01 BB 99 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 3F A7 1E 00 B2 05 06 50 00 00 00 00 00 00 04 00 00 00 3B 00 1D 00 10 41
⊞ Discover list descriptor	120 Bytes	00 00 00 00 20 20 20 20 20 20 FF FF 01 00 00 04 01 00 00 04 01 00 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 2A 80 00 00 2A 80 00 00 00 00 00 00 00 00 00 00 00 01 00 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 02 07 01 BB 99 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 3F A7 1E 00 B2 05 06 50 00 00 00 00 00 00 05 00 00 00 3B 00 1D 00 10 41
⊞ Discover list descriptor	120 Bytes	00 00 00 00 20 20 20 20 20 20 FF FF 01 00 00 04 01 00 00 04 01 00 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 2A 80 00 00 2A 80 00 00 00 00 00 00 00 00 00 00 00 01 00 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 02 07 01 BB 99 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 3F A7 1E 00 B2 05 06 50 00 00 00 00 00 00 06 00 00 00 3B 00 1D 00 10 41
⊞ Discover list descriptor	120 Bytes	00 00 00 00 20 20 20 20 20 20 FF FF 01 00 00 04 01 00 00 04 01 00 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 2A 80 00 00 2A 80 00 00 00 00 00 00 00 00 00 00 00 01 00 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 02 07 01 BB 99 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 3F A7 1E 00 B2 05 06 50 00 00 00 00 00 00 07 00 00 00 3B 00 1D 00 10 41

Figure 3.199: Descriptor Lists

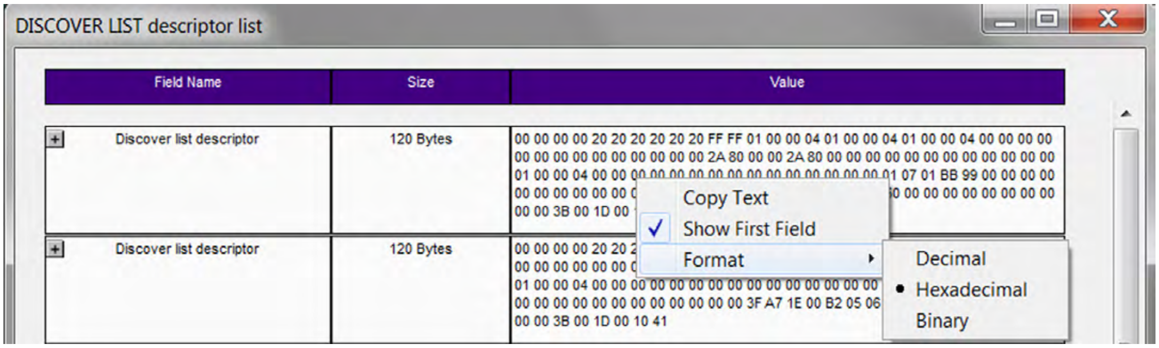
Click on the “+” sign in the first field to bring up a menu with more information abut the Discover list descriptor. See Figure 3.200 on page 275.



Field Name	Size	Value
Discover list descriptor	120 Bytes	00 00 00 00 20 20 20 20 20 20 FF FF 01 00 00 04 01 00 00 04 01 00 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 2A 80 00 00 2A 80 00 00 00 00 00 00 00 00 00 00 00 00 01 00 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01 07 01 BB 99 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 3F A7 1E 00 B2 05 06 50 00 00 00 00 00 00 00 00 00 00 3B 00 1D 00 10 41
SMP Frame Type	1 Byte	41 = Response
Function	1 Byte	10 = Discover
Function Result	1 Byte	00 = Smp function accepted
Response Length	1 Byte	29
Expander Change Count	2 Bytes	59
Reserved	3 Bytes	00 00 00
Phy Identifier	1 Byte	0
Reserved	2 Bytes	00 00
Attached reason	4 Bits	00
Attached Device Type	3 Bits	00 = No device attached
Reserved	1 Bit	00
Negotiated logical link rate	4 Bits	00
Reserved	4 Bits	00
Attached SATA Host	1 Bit	00
Attached SMP Initiator	1 Bit	00
Attached STP Initiator	1 Bit	00
Attached SSP Initiator	1 Bit	00
Reserved	4 Bits	00

Figure 3.200: Details of a Single Discover List Descriptor

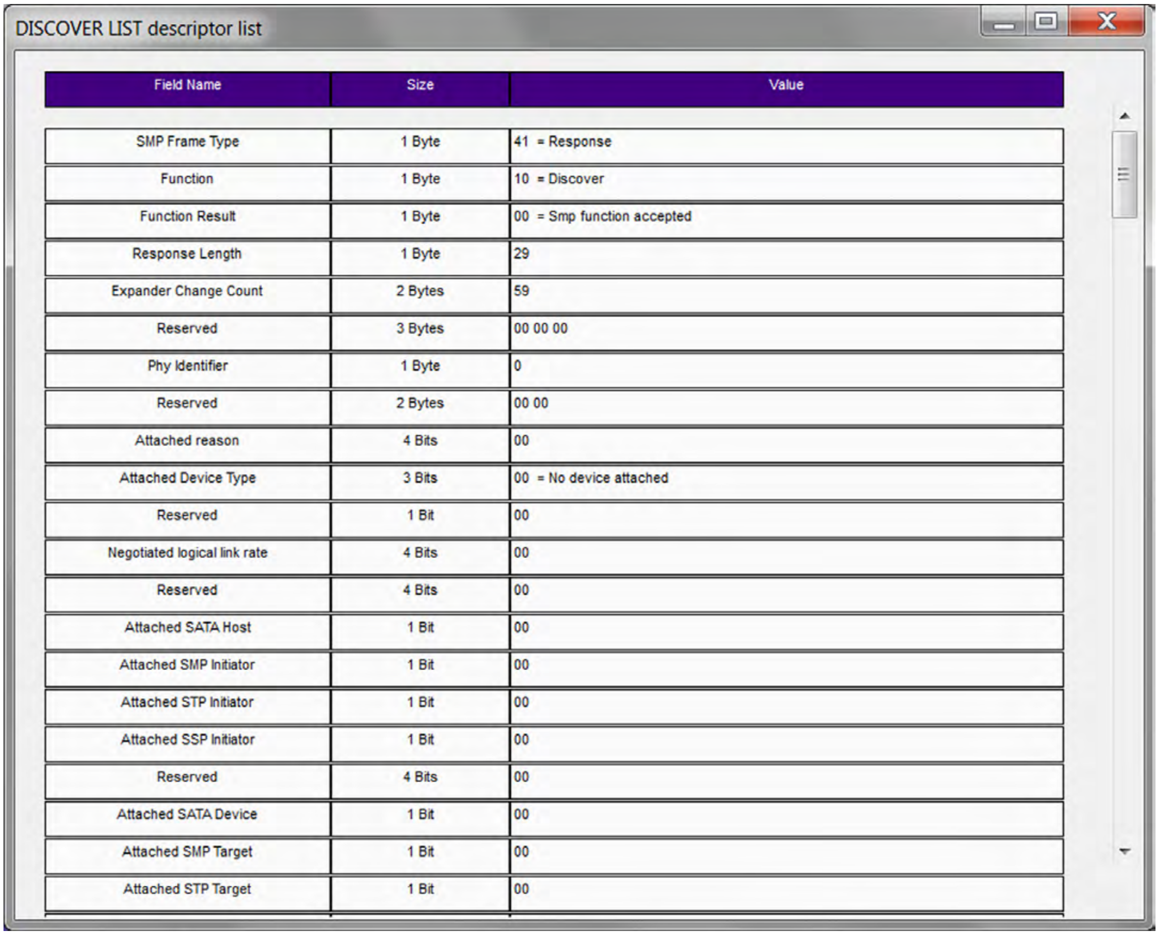
If you right click in the Value Field you can Copy text, Show First Field or Change the data format to binary, decimal or leave it in hexadecimal format. See Figure 3.201 on page 275.



Field Name	Size	Value
Discover list descriptor	120 Bytes	00 00 00 00 20 20 20 20 20 20 FF FF 01 00 00 04 01 00 00 04 01 00 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 2A 80 00 00 2A 80 00 00 00 00 00 00 00 00 00 00 00 00 01 00 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01 07 01 BB 99 00 00 00 00 00 00 00 00 00 00 0 0 00 00 00 00 00 00 00 00 00 00 3B 00 1D 00
Discover list descriptor	120 Bytes	00 00 00 00 20 20 2 00 00 00 00 00 00 0 01 00 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 3F A7 1E 00 B2 05 06 00 00 3B 00 1D 00 10 41

Figure 3.201: Discover List Descriptor List Showing Different Options and Formats

If you de-select Show First Field the Data will be shown as Function, Data Size and value of the data with an explanation. See Figure 3.202 on page 276.

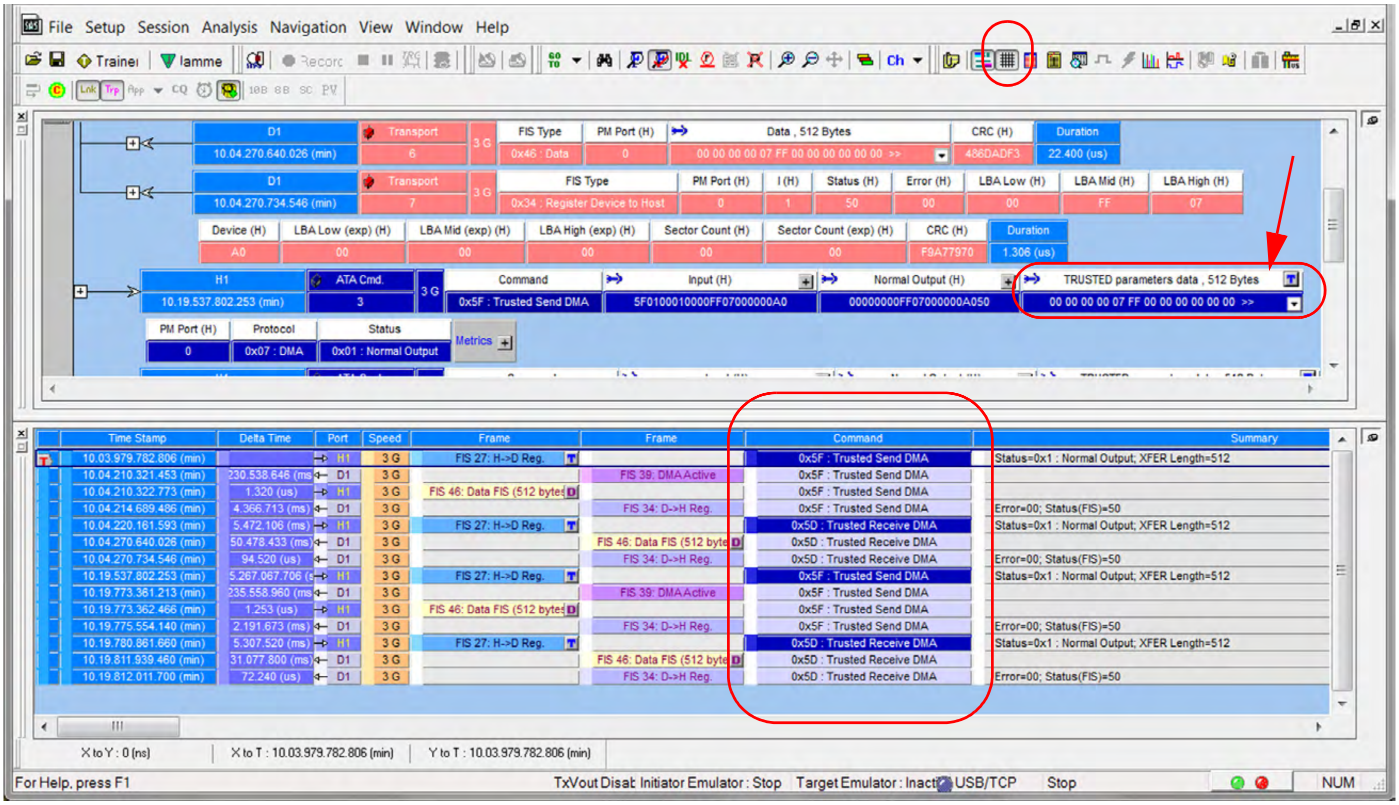


Field Name	Size	Value
SMP Frame Type	1 Byte	41 = Response
Function	1 Byte	10 = Discover
Function Result	1 Byte	00 = Smp function accepted
Response Length	1 Byte	29
Expander Change Count	2 Bytes	59
Reserved	3 Bytes	00 00 00
Phy Identifier	1 Byte	0
Reserved	2 Bytes	00 00
Attached reason	4 Bits	00
Attached Device Type	3 Bits	00 = No device attached
Reserved	1 Bit	00
Negotiated logical link rate	4 Bits	00
Reserved	4 Bits	00
Attached SATA Host	1 Bit	00
Attached SMP Initiator	1 Bit	00
Attached STP Initiator	1 Bit	00
Attached SSP Initiator	1 Bit	00
Reserved	4 Bits	00
Attached SATA Device	1 Bit	00
Attached SMP Target	1 Bit	00
Attached STP Target	1 Bit	00

Figure 3.202: Data Shown as Function, Data Size and Value

3.27 Trusted Command Group Decodes in Spreadsheet View

Trusted Command Group (TCG) decodes are now available in the Spreadsheet View. See Figure 3.203 on page 277.


File Setup Session Analysis Navigation View Window Help
D1
Transport
FIS Type
PM Port (H)
Data , 512 Bytes
CRC (H)
Duration
ATA Cmd.
Command
Input (H)
Normal Output (H)
TRUSTED parameters data , 512 Bytes
00 00 00 00 07 FF 00 00 00 00 00 00 >>
Metrics

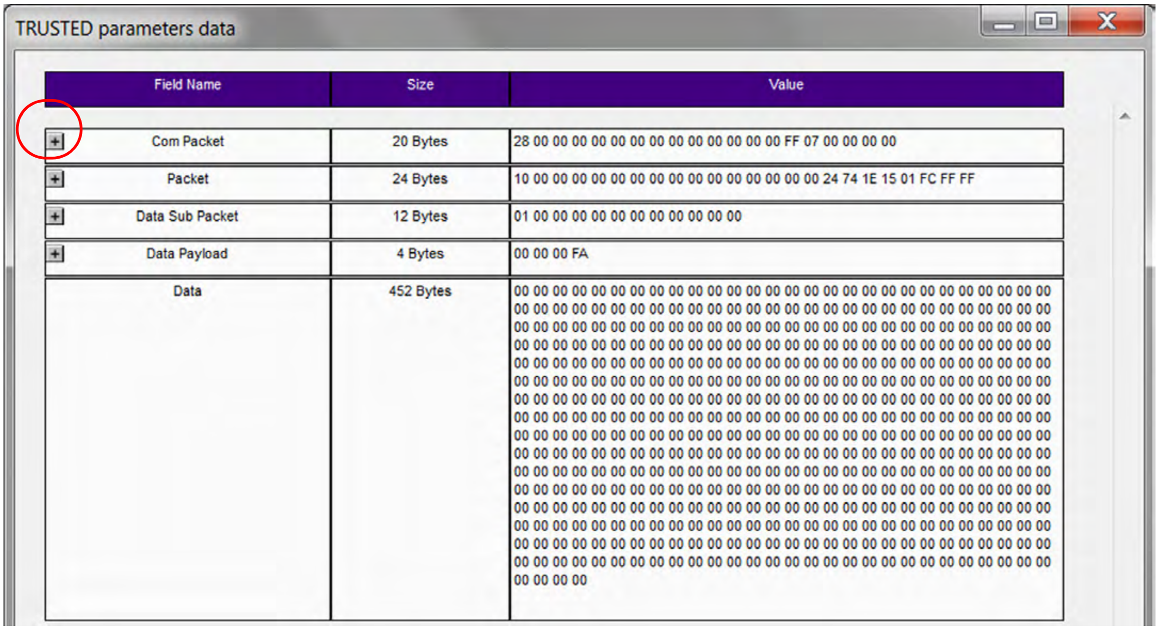
Time Stamp	Delta Time	Port	Speed	Frame	Frame	Command	Summary
10.03.979.782.806 (min)		H1	3 G	FIS 27: H->D Reg.		0x5F : Trusted Send DMA	Status=0x1 : Normal Output; XFER Length=512
10.04.210.321.453 (min)	230.538.646 (ms	D1	3 G		FIS 39: DMA Active	0x5F : Trusted Send DMA	
10.04.210.322.773 (min)	1.320 (us)	H1	3 G	FIS 46: Data FIS (512 bytes		0x5F : Trusted Send DMA	
10.04.214.689.486 (min)	4.366.713 (ms)	D1	3 G		FIS 34: D->H Reg.	0x5F : Trusted Send DMA	Error=00; Status(FIS)=50
10.04.220.161.593 (min)	5.472.106 (ms)	H1	3 G	FIS 27: H->D Reg.		0x5D : Trusted Receive DMA	Status=0x1 : Normal Output; XFER Length=512
10.04.270.640.026 (min)	50.478.433 (ms)	D1	3 G		FIS 46: Data FIS (512 byte	0x5D : Trusted Receive DMA	
10.04.270.734.546 (min)	94.520 (us)	D1	3 G		FIS 34: D->H Reg.	0x5D : Trusted Receive DMA	Error=00; Status(FIS)=50
10.19.537.802.253 (min)	5.267.067.706 (s	H1	3 G	FIS 27: H->D Reg.		0x5F : Trusted Send DMA	Status=0x1 : Normal Output; XFER Length=512
10.19.773.361.213 (min)	235.558.960 (ms	D1	3 G		FIS 39: DMA Active	0x5F : Trusted Send DMA	
10.19.773.362.466 (min)	1.253 (us)	H1	3 G	FIS 46: Data FIS (512 bytes		0x5F : Trusted Send DMA	
10.19.775.554.140 (min)	2.191.673 (ms)	D1	3 G		FIS 34: D->H Reg.	0x5F : Trusted Send DMA	Error=00; Status(FIS)=50
10.19.780.861.660 (min)	5.307.520 (ms)	H1	3 G	FIS 27: H->D Reg.		0x5D : Trusted Receive DMA	Status=0x1 : Normal Output; XFER Length=512
10.19.811.939.460 (min)	31.077.800 (ms)	D1	3 G		FIS 46: Data FIS (512 byte	0x5D : Trusted Receive DMA	
10.19.812.011.700 (min)	72.240 (us)	D1	3 G		FIS 34: D->H Reg.	0x5D : Trusted Receive DMA	Error=00; Status(FIS)=50

X to Y : 0 (ns) X to T : 10.03.979.782.806 (min) Y to T : 10.03.979.782.806 (min)

For Help, press F1 TxVout Disat Initiator Emulator : Stop Target Emulator : Inact USB/TCP Stop NUM

Figure 3.203: Trace Showing Trusted Command Group data in Spreadsheet View

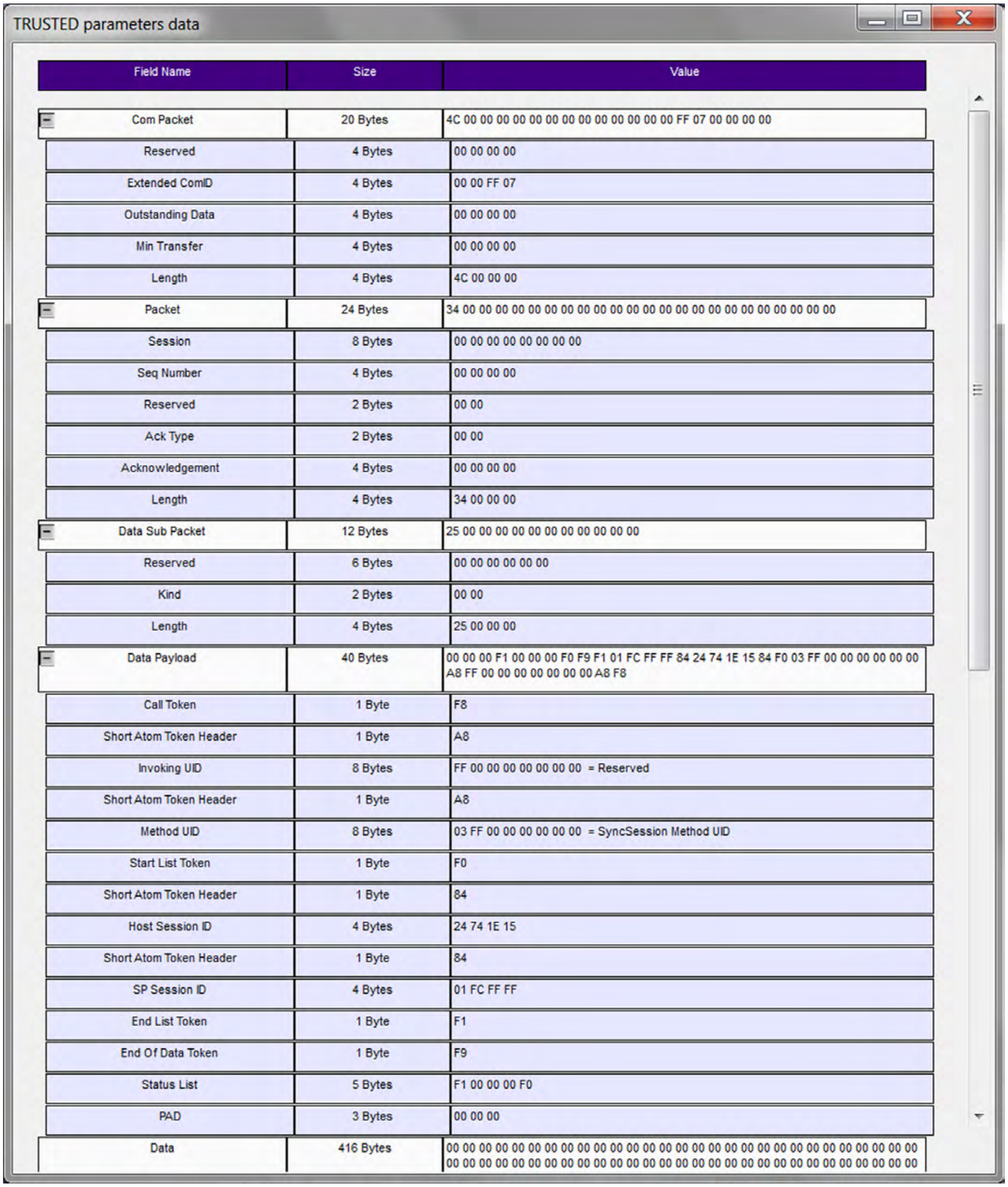
If you click on the TCG icon in the trace a window with detailed data about the TCG packet will pop up. The different Fields shown include: Com Packet, Packet, Data Sub Packet, Data Payload and Data. See Figure 3.204 on page 277.


TRUSTED parameters data

Field Name	Size	Value
+ Com Packet	20 Bytes	28 00 00 00 00 00 00 00 00 00 00 00 00 00 FF 07 00 00 00 00
+ Packet	24 Bytes	10 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 24 74 1E 15 01 FC FF FF
+ Data Sub Packet	12 Bytes	01 00 00 00 00 00 00 00 00 00 00 00
+ Data Payload	4 Bytes	00 00 00 FA
Data	452 Bytes	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

Figure 3.204: TCG Parameter Data Field Name, Size and Values

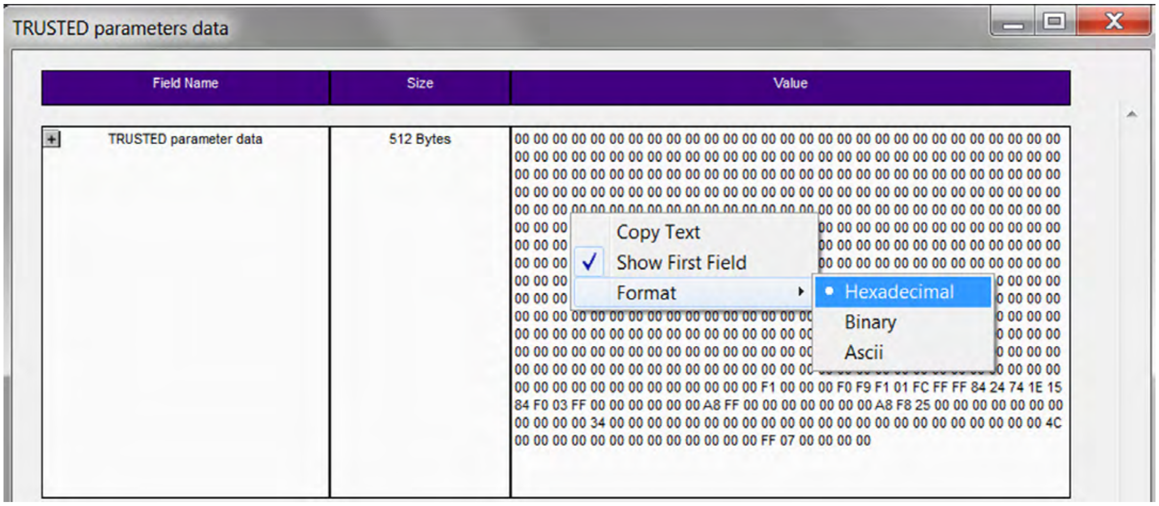
Clicking on the “+” symbol in any of the Field Name boxes will pop up a window with more detailed information about the particular Field. See Figure 3.205 on page 278.


TRUSTED parameters data

Field Name	Size	Value
Com Packet	20 Bytes	4C 00 00 00 00 00 00 00 00 00 00 00 00 00 FF 07 00 00 00 00
Reserved	4 Bytes	00 00 00 00
Extended ComID	4 Bytes	00 00 FF 07
Outstanding Data	4 Bytes	00 00 00 00
Min Transfer	4 Bytes	00 00 00 00
Length	4 Bytes	4C 00 00 00
Packet	24 Bytes	34 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
Session	8 Bytes	00 00 00 00 00 00 00 00
Seq Number	4 Bytes	00 00 00 00
Reserved	2 Bytes	00 00
Ack Type	2 Bytes	00 00
Acknowledgement	4 Bytes	00 00 00 00
Length	4 Bytes	34 00 00 00
Data Sub Packet	12 Bytes	25 00 00 00 00 00 00 00 00 00 00 00
Reserved	6 Bytes	00 00 00 00 00 00
Kind	2 Bytes	00 00
Length	4 Bytes	25 00 00 00
Data Payload	40 Bytes	00 00 00 F1 00 00 00 F0 F9 F1 01 FC FF FF 84 24 74 1E 15 84 F0 03 FF 00 00 00 00 00 00 A8 FF 00 00 00 00 00 00 00 A8 F8
Call Token	1 Byte	F8
Short Atom Token Header	1 Byte	A8
Invoking UID	8 Bytes	FF 00 00 00 00 00 00 00 = Reserved
Short Atom Token Header	1 Byte	A8
Method UID	8 Bytes	03 FF 00 00 00 00 00 00 = SyncSession Method UID
Start List Token	1 Byte	F0
Short Atom Token Header	1 Byte	84
Host Session ID	4 Bytes	24 74 1E 15
Short Atom Token Header	1 Byte	84
SP Session ID	4 Bytes	01 FC FF FF
End List Token	1 Byte	F1
End Of Data Token	1 Byte	F9
Status List	5 Bytes	F1 00 00 00 F0
PAD	3 Bytes	00 00 00
Data	416 Bytes	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

Figure 3.205: Detailed Look at Data for Each Packet, Payload or Data

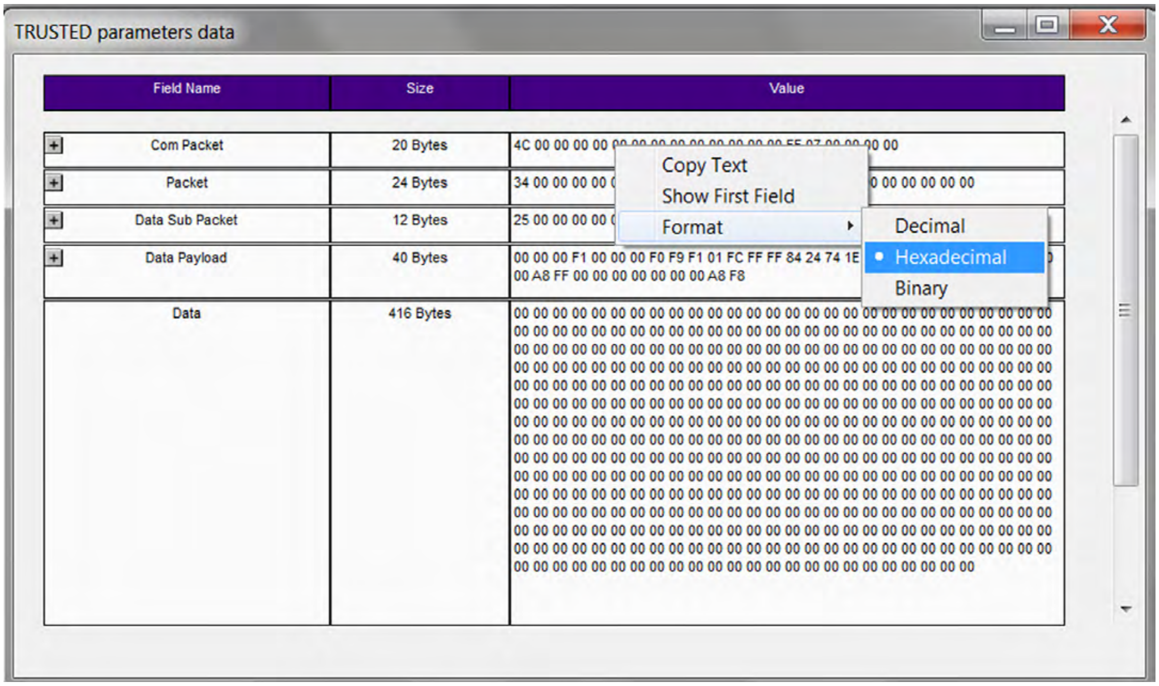
With the cursor inn each field, if you perform a right click a menu pops up showing that you can Copy Text, Show First Field (if selected) and change the format of the data shown (Hex, Binary or ASCII). See Figure 3.206 on page 279.



Field Name	Size	Value
⊞ TRUSTED parameter data	512 Bytes	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 0 00 00 00 00 00 00 0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 F1 00 00 00 F0 F9 F1 01 FC FF FF 84 24 74 1E 15 84 F0 03 FF 00 00 00 00 00 00 A8 FF 00 00 00 00 00 00 00 A8 F8 25 00 00 00 00 00 00 00 00 00 00 00 34 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 4C 00 00 00 00 00 00 00 00 00 00 00 00 00 FF 07 00 00 00 00

Figure 3.206: TCG showing Copy Text, Show First Field and Changing Format of Data

If you de-select Show First Field the Data will be shown as Function, Data Size and value of the data with an explanation. See Figure 3.207 on page 279.



Field Name	Size	Value
⊞ Com Packet	20 Bytes	4C 00 00 00 00 00 00
⊞ Packet	24 Bytes	34 00 00 00 00 0 00 00 00 00 00
⊞ Data Sub Packet	12 Bytes	25 00 00 00 00
⊞ Data Payload	40 Bytes	00 00 00 F1 00 00 00 F0 F9 F1 01 FC FF FF 84 24 74 1E 00 A8 FF 00 00 00 00 00 00 00 A8 F8
Data	416 Bytes	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

Figure 3.207: TCG showing Copy Text, No Show First Field and Changing Format of Data

3.28 Exporting LBA, XFER Length and Tag from Spreadsheet View

From an open Trace in Spreadsheet display mode, you can now Export and SaveAs LBA, Transfer Length and Tag data in different formats: Text 1.0/2.0 and Excel 1.0/2.0 as well as hexadecimal, decimal or binary. See Figure 3.208 on page 280.

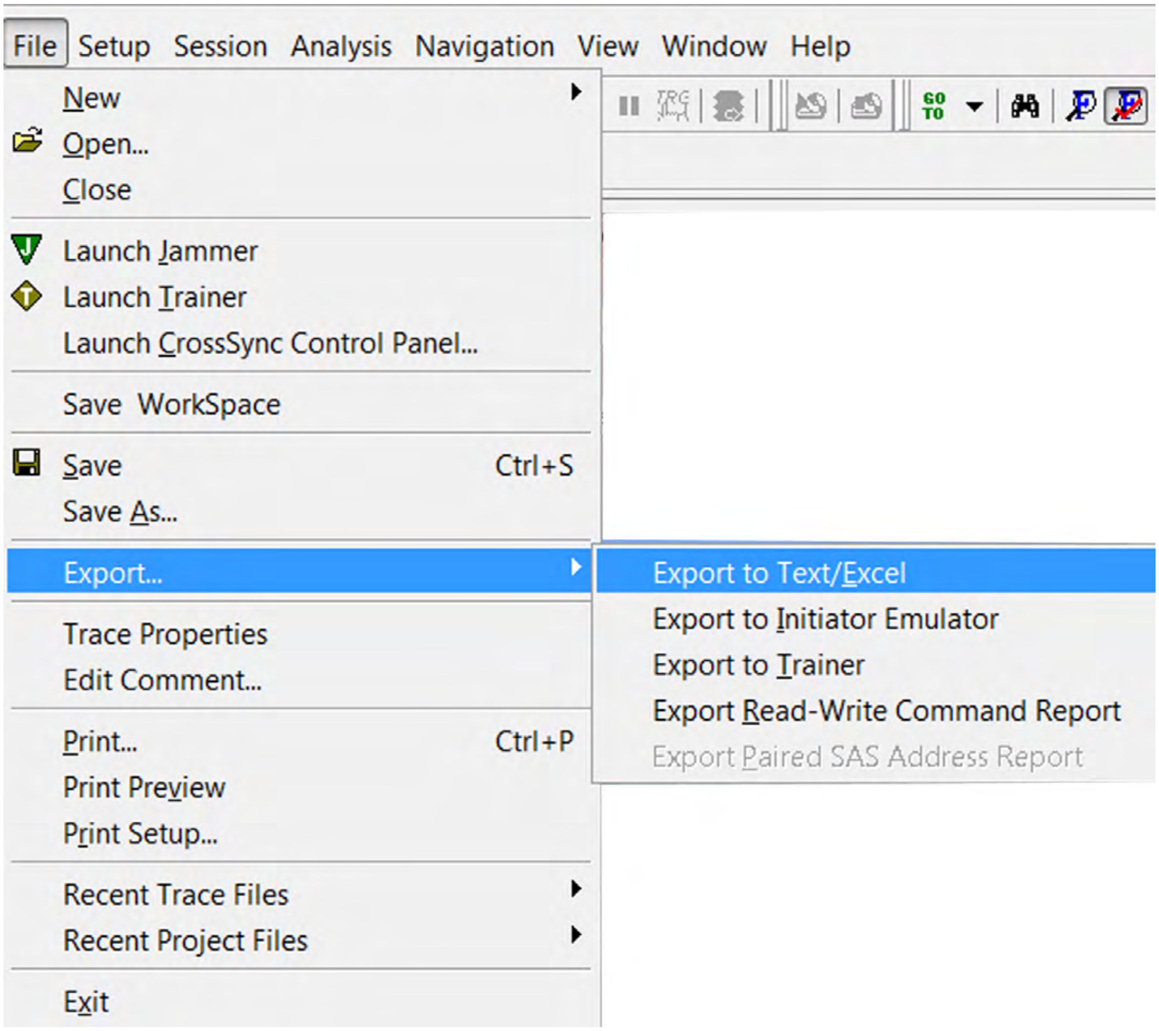
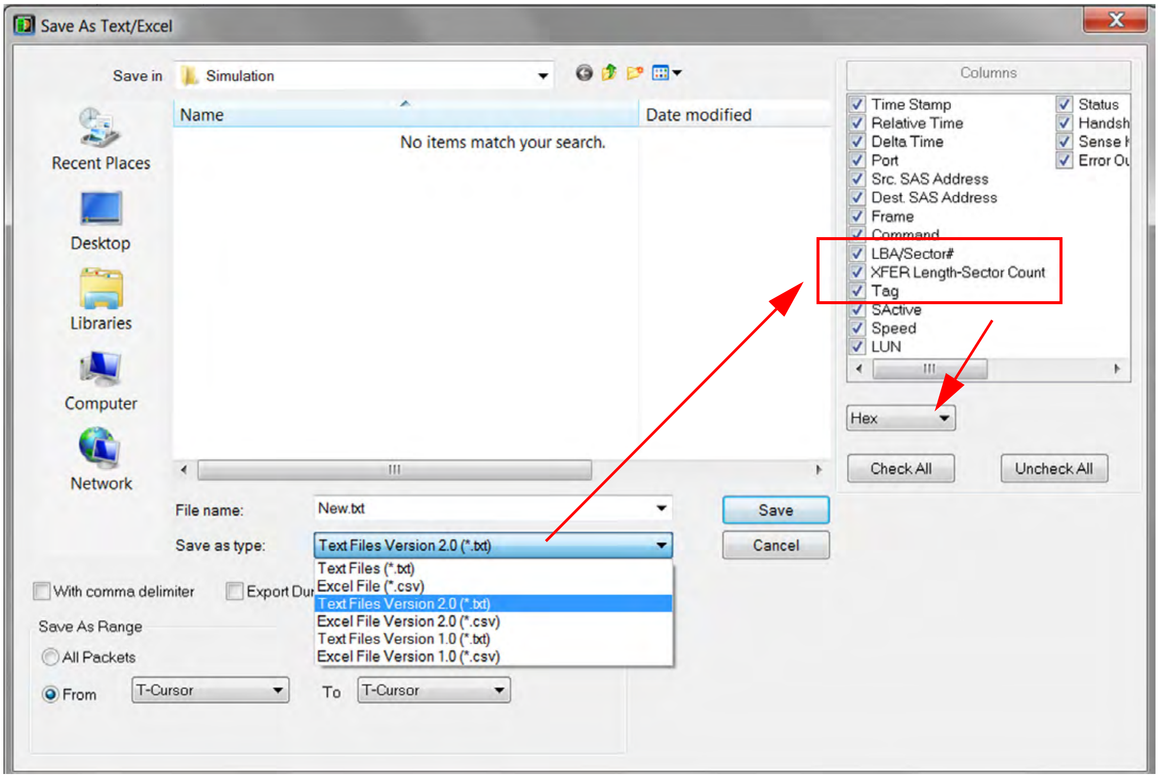

File
Setup
Session
Analysis
Navigation
View
Window
Help
New
Open...
Close
Launch Jammer
Launch Trainer
Launch CrossSync Control Panel...
Save WorkSpace
Save Ctrl+S
Save As...
Export...
Trace Properties
Edit Comment...
Print... Ctrl+P
Print Preview
Print Setup...
Recent Trace Files
Recent Project Files
Exit
Export to Text/Excel
Export to Initiator Emulator
Export to Trainer
Export Read-Write Command Report
Export Paired SAS Address Report

Figure 3.208: Export --> Export Text/Excel

This will bring up a SaveAs menu. See Figure 3.209 on page 281.


Save in: Simulation

File name: New.txt

Save as type: Text Files Version 2.0 (*.txt)

From: T-Cursor To: T-Cursor

Hex

Save As Text/Excel
Recent Places
Desktop
Libraries
Computer
Network
Name
Date modified
No items match your search.
Save
Cancel
Text Files (*.txt)
Excel File (*.csv)
Text Files Version 2.0 (*.txt)
Excel File Version 2.0 (*.csv)
Text Files Version 1.0 (*.txt)
Excel File Version 1.0 (*.csv)
☐ With comma delimiter
☐ Export Dur
Save As Range
○ All Packets
● From
Columns
☑ Time Stamp
☑ Relative Time
☑ Delta Time
☑ Port
☑ Src. SAS Address
☑ Dest. SAS Address
☑ Frame
☑ Command
☑ LBA/Sector#
☑ XFER Length-Sector Count
☑ Tag
☑ SActive
☑ Speed
☑ LUN
☑ Status
☑ Handsh
☑ Sense I
☑ Error Ou
Check All
Uncheck All

Figure 3.209: Select Text Files Version 1.0/2.0 or Excel File Version 1.0/2.0

LBA/Sector#, XFER Length-Sector Count and Tag will bring up a option to save the data in hexadecimal, decimal or binary format. See Figure 3.210 on page 282.

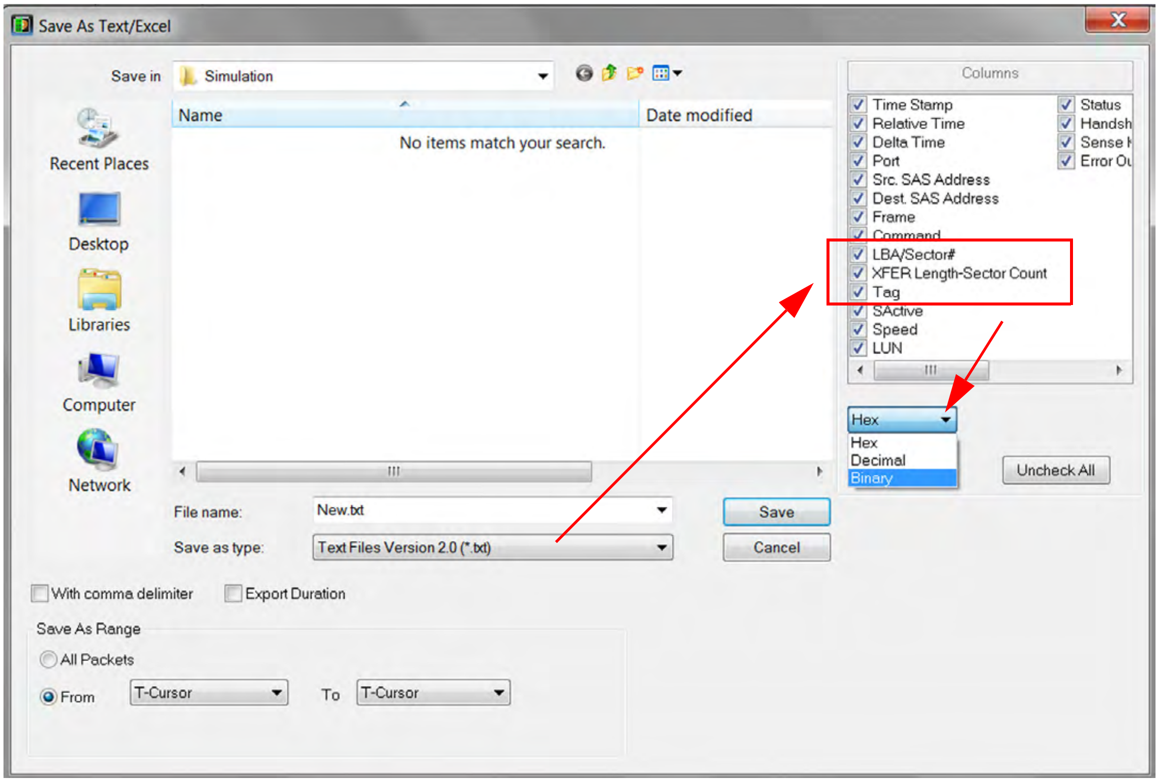

Save As Text/Excel
Save in
Simulation
Recent Places
Desktop
Libraries
Computer
Network
Name
Date modified
No items match your search.
File name:
New.txt
Save as type:
Text Files Version 2.0 (*.txt)
Save
Cancel
☐ With comma delimiter
☐ Export Duration
Save As Range
○ All Packets
● From
T-Cursor
To
T-Cursor
Columns
☑ Time Stamp
☑ Relative Time
☑ Delta Time
☑ Port
☑ Src. SAS Address
☑ Dest. SAS Address
☑ Frame
☑ Command
☑ LBA/Sector#
☑ XFER Length-Sector Count
☑ Tag
☑ SActive
☑ Speed
☑ LUN
☑ Status
☑ Handsh
☑ Sense k
☑ Error Ou
Hex
Hex
Decimal
Binary
Uncheck All

Figure 3.210: Save Data as Hex, Decimal or Binary

Chapter 4

InFusion Overview

The LeCroy InFusion™ Error Injector and Traffic Modifier is an error injector and traffic modification tool that allows you to verify real-world fault handling for Serial Attached SCSI (SAS) and Serial ATA (SATA) systems. InFusion can sit unobtrusively in the data path on a live system to programmatically alter or corrupt traffic. InFusion is the ideal tool for stress-testing systems using actual workloads.

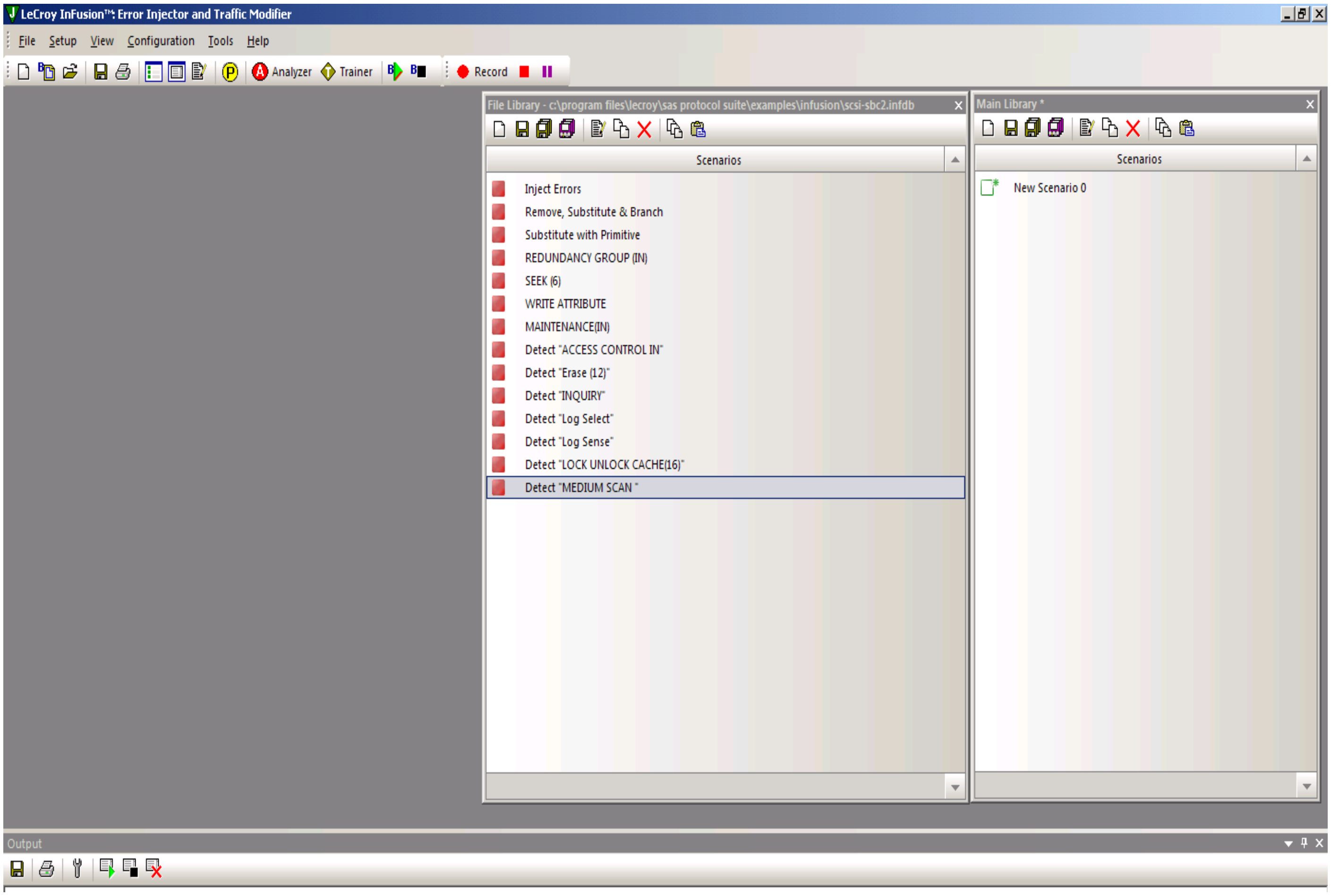

LeCroy InFusion™: Error Injector and Traffic Modifier
File
Setup
View
Configuration
Tools
Help
Analyzer
Trainer
Record
File Library - c:\program files\lecroy\sas protocol suite\examples\infusion\scsi-sbc2.infdb
Scenarios
Inject Errors
Remove, Substitute & Branch
Substitute with Primitive
REDUNDANCY GROUP (IN)
SEEK (6)
WRITE ATTRIBUTE
MAINTENANCE(IN)
Detect "ACCESS CONTROL IN"
Detect "Erase (12)"
Detect "INQUIRY"
Detect "Log Select"
Detect "Log Sense"
Detect "LOCK UNLOCK CACHE(16)"
Detect "MEDIUM SCAN "
Main Library *
Scenarios
New Scenario 0
Output

Figure 4.1: InFusion Windows.

InFusion supports SAS SSP, SMP, STP, and SATA-based protocols operating across a single SAS or SATA link up to 12 G. InFusion monitors traffic from both directions in real-time and relies on predefined rules to replace any bit, primitive, or parameter with one you specify. InFusion can change traffic when it detects a specific sequence or reaches a designated time interval, yet it requires no complicated scripts, programming, or simulation tools.

InFusion can monitor traffic in both directions and act on events occurring in either direction of the communications link. InFusion can modify traffic in only one direction within a given test scenario, but that direction can be either from the Initiator or from the Target.

InFusion is specifically designed to verify recovery characteristics within a subsystem. An easy pop-up menu interface allows you to create specific test scenarios in just minutes.

Once a InFusion session starts, the system automatically handles protocol handshaking between devices. InFusion transmits a faithful copy of the original data stream down to the CRC value which, if needed, it recalculates. InFusion allows test engineers to systematically verify error recovery in ways not possible with other test platforms.

An Infusion event can trigger an analyzer.

Infusion supports all commands in the SATA 3.0 specification.

4.1 Key Features

The key features of InFusion are:

- **Error Injection**: Injects CRC, disparity, 8b/10b encoding, framing, and coding errors.
- **Break Link Recovery**: Programmatically breaks the connection to test link recovery.
- **Value Replacement**: Monitors the link for specific values, patterns, or primitives (as low as bit level) and replace with user-defined values. You can replace values on every occurrence, after a specified number of occurrences, or after a specified time interval.
- **Packet Drop**: Removes individual primitives, address frames, or data frames from the stream to verify retry behavior.
- **Primitive Manipulation**: Replaces handshaking and flow control primitives to help validate robustness of a design.
- **Traffic Monitoring:** Operates as a traffic monitor, collecting statistical data on user-specified parameters. In this mode, data passes unchanged in both directions.
- **Menu-Driven Interface:** Allows easy set-up of test scenarios.
- **API based on C++:** Allows development of custom test applications.
- **Scenario Batch Files:** Allows scenario scripts.

With respect to traffic modification, in the Link Layer you can modify primitives, CRC, scrambled traffic, and SSP, SMP, and STP connection events. You cannot modify clock skew management, OOB and power management, and signal integrity.

InFusion consists of a hardware device that connects to the line under test and a Windows-based software application used to create and download test scripts to the device. You also can use the software application to configure and control the device across an Ethernet link.

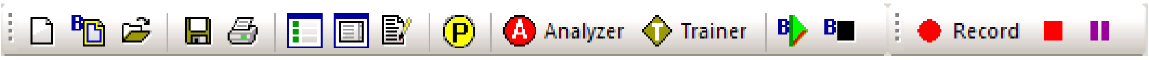
InFusion test scripts are called scenarios. Scenarios determine how the hardware device monitors and modifies line traffic. You must use the application to create and download scenarios.

For the InFusion connections, the device is connected between the SAS/SATA host and the PHY of the test target (DUT). Link training is not performed transparently because the FPGA cannot manipulate the required physical probe settings. Hence, training sequences and speed negotiation cannot be jammed. Another side effect is that pre-jam and post-jam recordings during these events are not the same.

4.2 Interface

4.2.1 Buttons

The InFusion interface has the following command buttons:



New Scenario: Begins the scenario creation process by listing Scenario Name, Direction for traffic changes, and Global Rules in the scenario window.

New Batch Script: Starts a scenario batch file in Batch Script window.

Open Library: Lists the InFusion Library Files (**.infdb**), which contain the available scenarios, in an Open dialog.

Save: Saves the current scenario in the UserData folder.

Print: Prints the current scenario.

Show Library: Displays/hides the Main Library window (on the right), which displays the available scenarios. You can create a new scenario, save a selected scenario, save the library, save a copy of the library, display the selected scenario, insert a copy of the selected item, or delete the selected scenario.

Show Output: Displays/hides the Output window (at the bottom), which displays InFusion output. Use the buttons to save output, print output, display options (automatically save the log file, with a path and size), start logging, stop logging, and clear the Output window.

Show Port Assignment: Displays/hides the current port assignment.

Port Configuration: Displays the port configuration dialog. See "Port Configuration for InFusion" on page 289.

Launch Analyzer: Returns to the Protocol Analyzer or Target/Host Emulator window.

Launch Trainer: Goes to the Trainer window.

Run Batch Script: Runs a scenario batch file.

Stop Batch Script: Stops a running scenario batch file.

Record: Starts recording on the current analyzer, using the current project.

Stop: Stops recording on the current analyzer.

Abort: Aborts recording.

4.2.2 Menus

The InFusion interface has the following menus:

File

See command descriptions in “Buttons” on page 285.

- ☐ New Scenario, Open Scenario (File Library or Main Library)
- ☐ Open an InFusion database (**.infdb** file)
- ☐ Launch Analyzer
- ☐ Launch Trainer
- ☐ New Batch Script, Save Batch Script As
- ☐ New Library, Close Library (File Library or Main Library), Save Library, Save Copy of Library As
- ☐ Open Log File
- ☐ Print Setup
- ☐ Recent Trace Files
- ☐ Recent Project Files
- ☐ Close

Setup

- ☐ External Trig Setting (see “External Trig Setting” on page 260)
- ☐ Update Device (see “Update Device” on page 261)
- ☐ All Connected Devices
- ☐ Status Bar

View

- ☐ Views (Library, Output, Port Assignment, Customize - commands, Toolbars, Keyboard, Menu and Options)
- ☐ Smart Docking
- ☐ Toolbar
- ☐ Status Bar

Configuration

- ☐ Port Configuration (see “Port Configuration for InFusion” on page 289)
- ☐ Batch Script Setting (see “Scenario Batch Files” on page 347)

Tools

Browse UserData, System, or InFusion folder.

Help

Help Topics and About InFusion.

4.2.3 Main Library

You can **Show Main Library**.

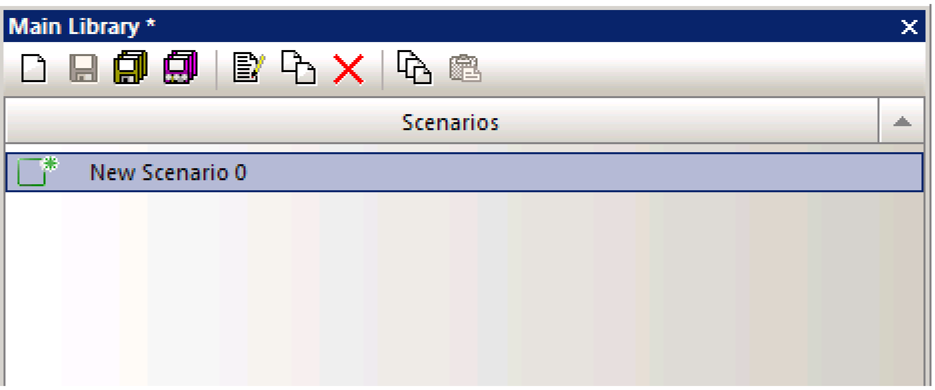

Main Library *
Scenarios
New Scenario 0

Figure 4.2: Main Library.

The Main Library has Scenarios.

Using the buttons from left to right, you can:

- ❑ Create a new scenario and save a scenario.
- ❑ Save a library and save a copy of a library.
- ❑ View/edit a scenario, insert copy of a scenario and delete scenario.
- ❑ Copy and paste.

4.2.4 File Library

You can display the File Library (see Figure 4.3 on page 287).

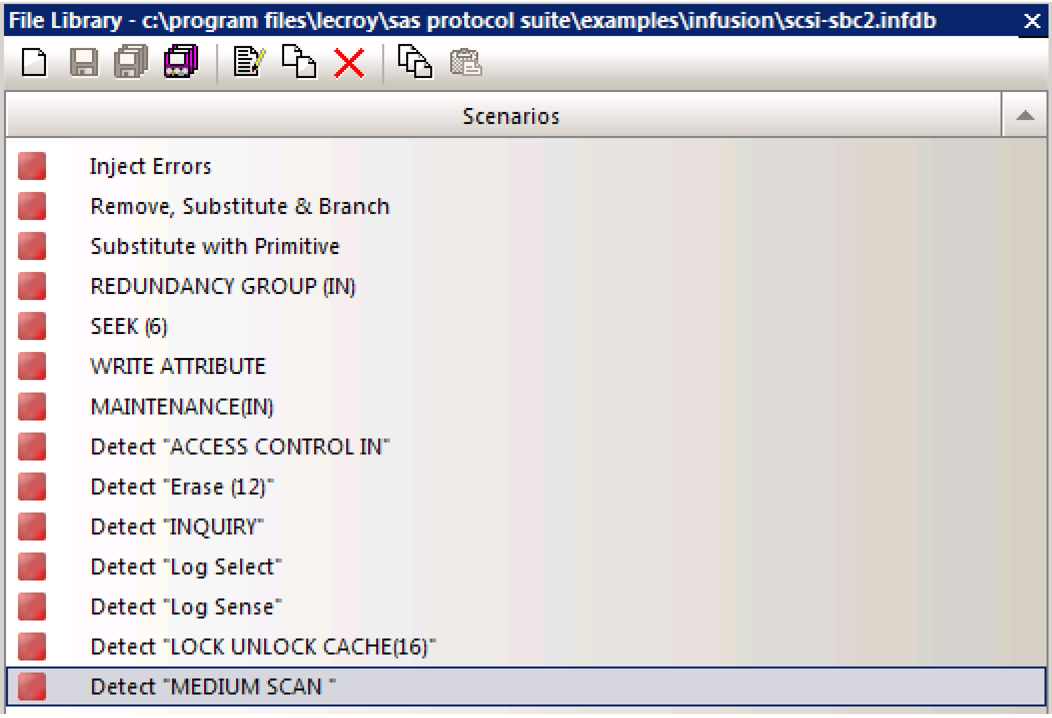

File Library - c:\program files\lecroy\sas protocol suite\examples\infusion\scsi-sbc2.infdb
Scenarios
Inject Errors
Remove, Substitute & Branch
Substitute with Primitive
REDUNDANCY GROUP (IN)
SEEK (6)
WRITE ATTRIBUTE
MAINTENANCE(IN)
Detect "ACCESS CONTROL IN"
Detect "Erase (12)"
Detect "INQUIRY"
Detect "Log Select"
Detect "Log Sense"
Detect "LOCK UNLOCK CACHE(16)"
Detect "MEDIUM SCAN "

Figure 4.3: File Library.

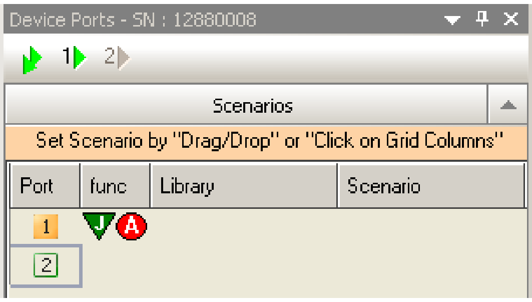
A File Library has Scenarios currently available in the device.

Using the buttons from left to right, you can:

- New scenario.
- Save selected scenario.
- Save library.
- Save a copy of the library as.
- View/edit a selected item.
- Insert a copy.
- Delete a selected scenario.
- Copy
- Paste

4.2.5 Device Ports

If a device is connected, the software displays the Device Ports.



Device Ports - SN : 12880008

Set Scenario by "Drag/Drop" or "Click on Grid Columns"

Port	func	Library	Scenario
1	J A		
2			

Figure 4.4: Device Ports

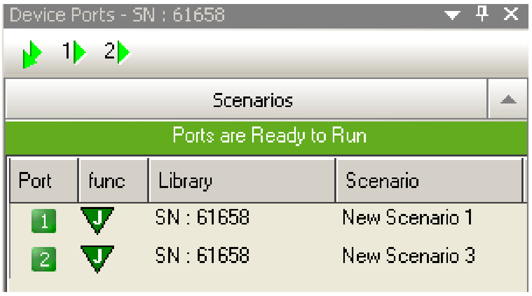
Using the first row of icons, you can Run/Stop All Ports or Run/Stop individual ports. The columns display the Port, Function/Configuration, Library, and Scenario. You can Float, Dock, Auto-Hide, or Hide the window.

Note: A port row is grayed-out when that port has not been configured to be a Jammer in the Port Configuration dialog (see “Port Configuration for InFusion” on page 289).

Using the Device Ports Dialog

After you have finished Port Configuration (see “Port Configuration for InFusion” on page 289), you use the Device Ports dialog to assign specific scenarios to ports, so that different scenarios can run on different ports.

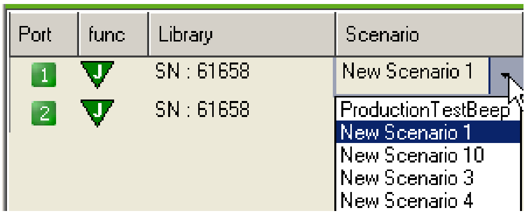
To assign a scenario to a port, drag and drop the scenario from any library window to the port. The Device Ports dialog then displays the Library and Scenario on the row for that Port/Configuration.


Device Ports - SN : 61658
1
2
Scenarios
Ports are Ready to Run

Port	func	Library	Scenario
1	J	SN : 61658	New Scenario 1
2	J	SN : 61658	New Scenario 3

Figure 4.5: Device Ports Dialog.

Alternatively, assign the scenario using the Library and Scenario drop-down lists.



Port	func	Library	Scenario
1	J	SN : 61658	New Scenario 1
2	J	SN : 61658	

ProductionTestBeep
New Scenario 1
New Scenario 10
New Scenario 3
New Scenario 4

Figure 4.6: Scenario Drop-down List.

After you have assigned scenarios to ports, in the first row of icons, use the first green arrow icon to **Run/Stop All Ports**, or use the numbered green arrows to **Run/Stop an individual port**.

Note: A port row is grayed-out when that port is running a scenario.

4.3 Port Configuration for InFusion

The InFusion (Jammer) port configurations must match the Analyzer port configurations for the infusion-analyzer to work.

Select **Configuration > Port Configuration** to display the Set Port Configuration dialog.

To record traffic both before and after the InFusion modifies (jams) it, select **Analyzer/Jammer/Analyzer** on the port that you want to jam. In the following figure, there is a match on Port 0.

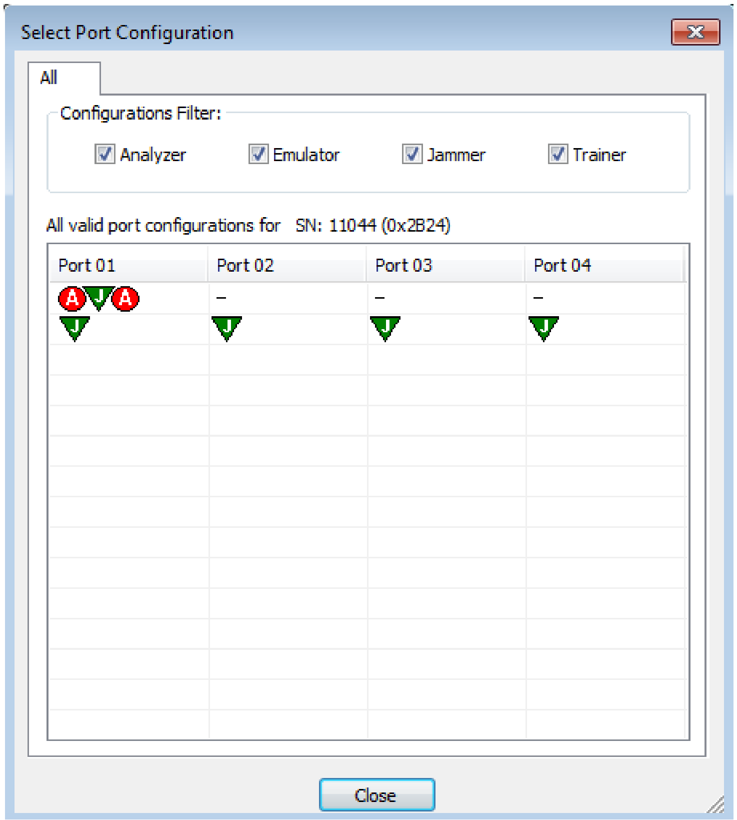

Select Port Configuration
All
Configurations Filter:
☑ Analyzer
☑ Emulator
☑ Jammer
☑ Trainer
All valid port configurations for SN: 11044 (0x2B24)
Port 01
Port 02
Port 03
Port 04
A
J
A
–
J
Close

Figure 4.7: Ports Configuration Dialog with InFusion/Analyzer Port Match.

Note: You can select only one Jammer port at a time with this configuration.

To record traffic from two ports after the InFusion modifies (jams) them, select a combination of ports that have **Jammer/Analyzer** specified under them. The different configurations accommodate different possible user setups and requirements.

Note: To display the current Port Configuration, click **Show Analyzer** to go to the analyzer application, then click the green button in the lower right corner to display the Port Status window (see "Port Status" on page 235).

4.4 InFusion Scenarios

You can create and execute InFusion scenarios. A scenario is a test script that defines how InFusion monitors and modifies line traffic.

4.4.1 Scenarios Overview

The InFusion application provides a menu-driven interface for building scenarios. The interface prompts you for simple decisions and choices from drop-down menus. As you make your selections, the script takes shape automatically in the scenario window. The script is in the form of simple English sentences. You need not understand any formal scripting language.(see Figure 4.8 on page 291 and Figure 4.9 on page 291).

To start, Select **File -> New Scenario** as shown below:

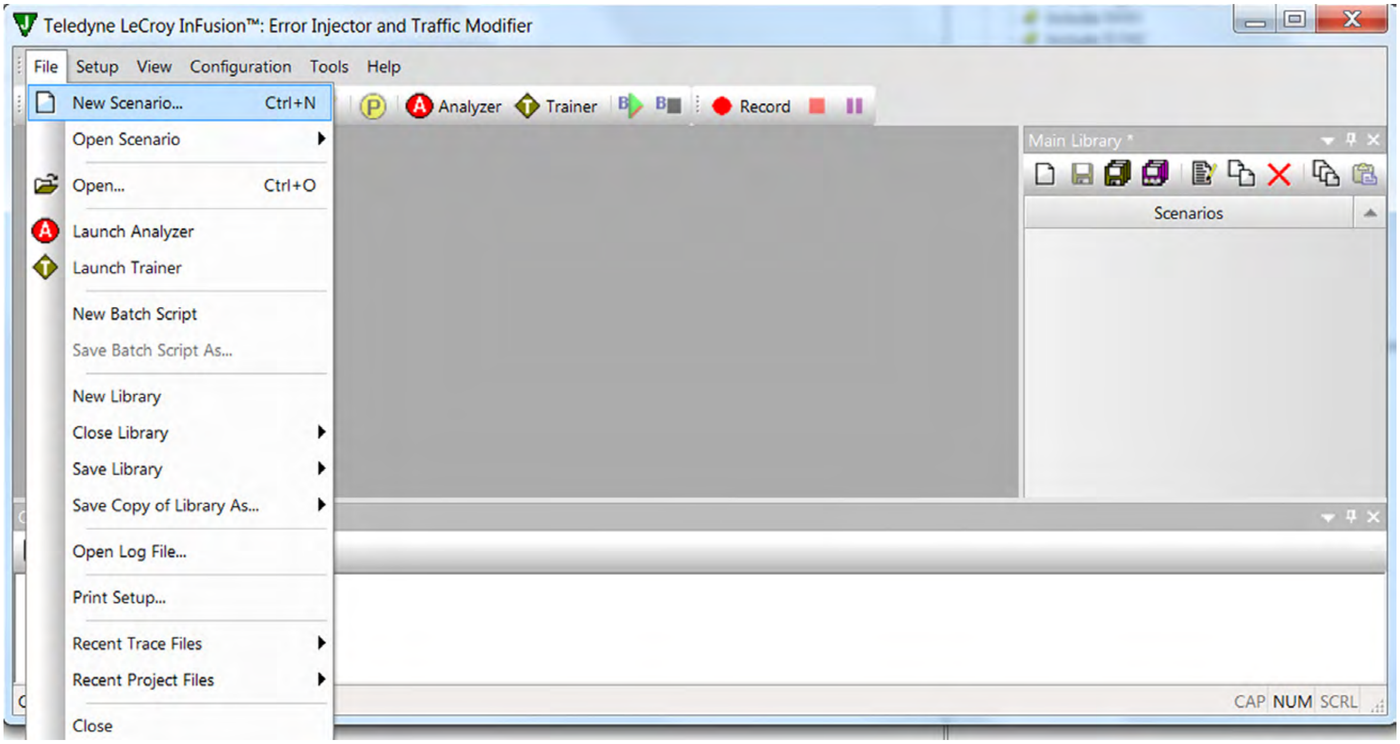
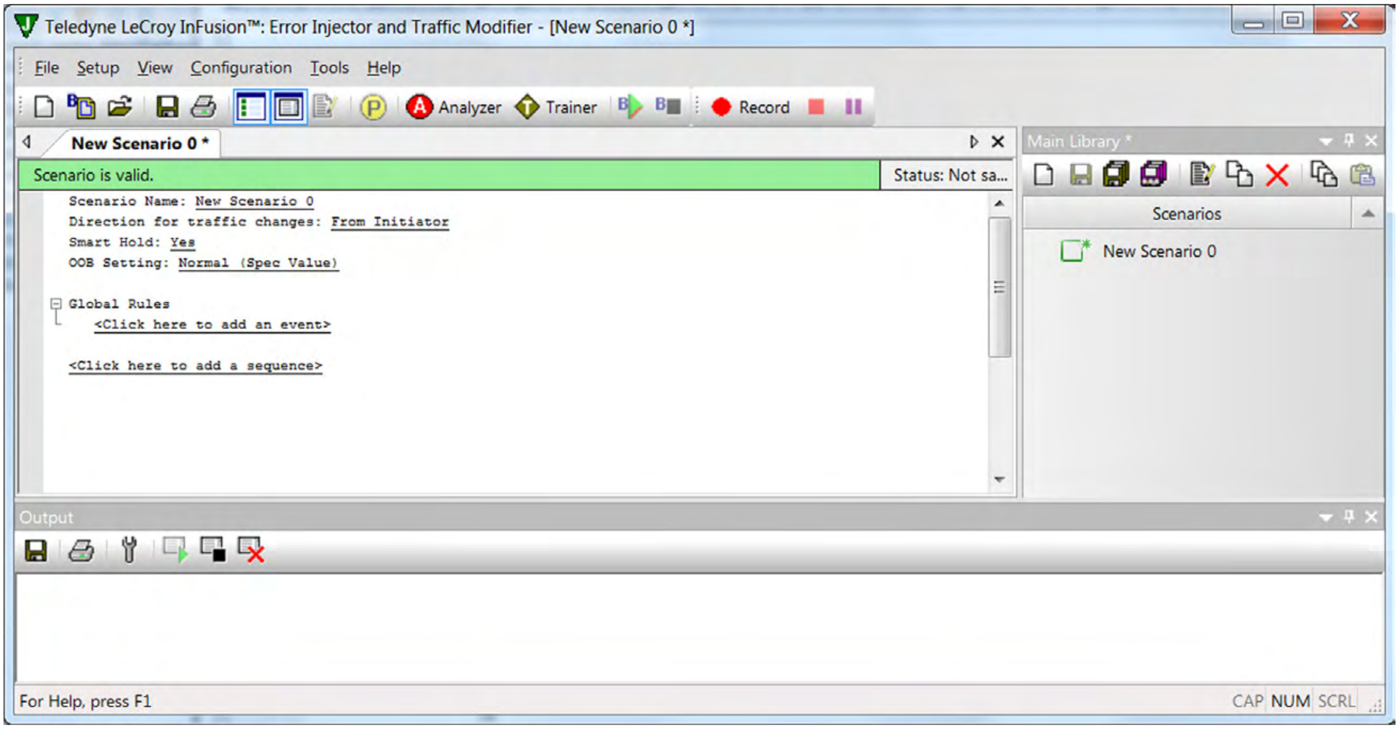

Teledyne LeCroy InFusion™: Error Injector and Traffic Modifier
File
Setup
View
Configuration
Tools
Help
New Scenario... Ctrl+N
Open Scenario
Open... Ctrl+O
Launch Analyzer
Launch Trainer
New Batch Script
Save Batch Script As...
New Library
Close Library
Save Library
Save Copy of Library As...
Open Log File...
Print Setup...
Recent Trace Files
Recent Project Files
Close
Analyzer
Trainer
Record
Main Library *
Scenarios
CAP NUM SCRL

Figure 4.8: Generate a New Scenario


Teledyne LeCroy InFusion™: Error Injector and Traffic Modifier - [New Scenario 0 *]
File
Setup
View
Configuration
Tools
Help
Analyzer
Trainer
Record
New Scenario 0 *
Main Library *
Scenarios
New Scenario 0
Output
For Help, press F1
CAP NUM SCRL

Scenario is valid.

Status: Not sa...

```
Scenario Name: New Scenario 0
Direction for traffic changes: From Initiator
Smart Hold: Yes
OOB Setting: Normal (Spec Value)

Global Rules
   <Click here to add an event>

<Click here to add a sequence>
```

Figure 4.9: Structure of New Scenario 0

InFusion Scenario Parameters

Timers

Timers allowed per state/sequence/scenario:

Two timers per state and six timers per scenario are allowed.

Events

Events allowed to be used per state/sequence/scenario:

For combined events, there is virtually no limit per state/sequence/scenario.

Actions

Actions allowed per state/sequence/scenario:

A maximum of 8 actions per state, 2048 actions per sequence (8*256 state), 4104 actions per scenario (2*2048 + 8 more in the Global Rules "state").

Monitors

Monitors allowed to be used per state/sequence/scenario:

InFusion can keep an account of 8/12 Monitor/Count events per scenario.

Random change of use of count and count randomly:

In Global Rules, if a Counter is used for Event counting, 2 extra actions are consumed. 2 more actions are required for "Every Nth occurrence" option.

In Sequences, If a Counter is used for Event counting, 3 extra actions are consumed. 3 more actions are required for "Every Nth occurrence" option.

Regarding limits on any of the above mentioned connections, i.e., x timers + y monitors are allowed per state where x+y=n:

There are a lot of big/small rules checked by the scenario compiler, but as a rule of thumb:

8 actions per state are available

12 counters globally are available, each assigned permanently to a certain job

6 available timers per scenario

12 programmable multi-purpose resources for DWORD comparison/substitution/capture are available. If a pattern detector uses 3 of these resources to trigger on a specific frame on the bus, only 9 more resources are available for other tasks. Frame/FIS type detectors are excluded from this rule, because they use their own dedicated resources.

8 primitive detectors are available

If you want to trigger on a pattern (Frame/FIS) and change/capture a dword(s) before the last offset of a detected pattern (e.g., changing the Frame Type of a SAS Frame with Data Offset == 11223344), you are limited to a maximum of 9 dword offset (i.e., if you trigger on the 20th payload of a Data FIS, you can change/capture the 12th dword onwards. 11th payload dword and preceding dwords are not accessible for change/capture)

You can not change a state based on back-to-back events. At 6G speed, there should be at least one dword between the triggering event of two consecutive states. At other speeds, back-to-back dword state transitions might rarely be missed, so best practice is to never assume back-to-back dword events.

As described later in this chapter, you can create any number of scenarios and store them in libraries on the PC hard drive. Scenario library files names are in the following format:

<*filename*>.infdb

Creating InFusion scenarios is easy, but it requires an understanding of the following terms defined in Table 4.1 on page 293.

TABLE 4.1: Key Scenario Terms

Term	Definition
Action	InFusion response to an event.
Event	Condition that is detectable by InFusion.
Combined Event	Logical OR association of events (for example, event A OR event B).
Global Rules	Portion of a scenario that can define a single InFusion test state. You can think of the Global Rules and each sequence as a separate test routine or program operating within the scenario. Each operates independently and in parallel with the others. The purpose of each is to detect events and then respond with the appropriate action or set of actions. In essence, you can operate up to three test states simultaneously within InFusion.
Sequence	Portion of a scenario that can define multiple InFusion test states. More flexible than the Global Rules, a sequence allows more powerful scenarios that include branching and looping between test states (Global Rules can define only a single test state, so there is no branching).
State	“Behavior” of the Global Rules or a sequence at any point in time. In terms of InFusion testing, behavior is “waiting” for a set of events and responding with a set of actions.

4.4.2 Global Rules

Global Rules are a portion of the scenario that can define only one test state. To create the Global Rules, you use the menu-driven interface to enter an event or combined event and the corresponding action or set of actions (the response of InFusion hardware to the event).

In the case of a combined event, the action is taken upon occurrence of any of the events stated for the event combination. It is a logical OR association, meaning any of the events can trigger the action.

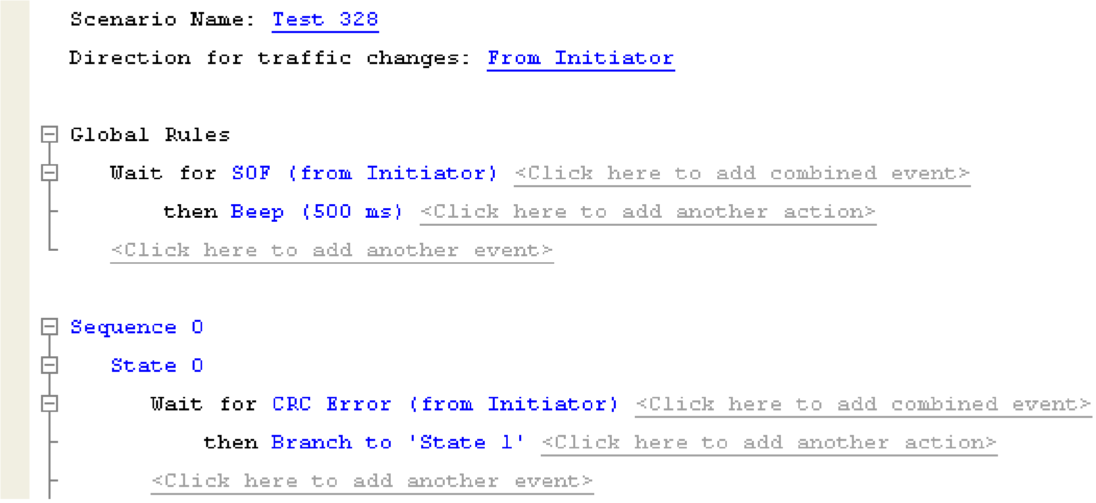
After you enter the event or combined event, the interface prompts you for actions. An action might be, for example, injecting a particular primitive or error into the traffic stream. You can enter multiple actions, which take place simultaneously.

After defining the event and actions within the Global Rule area, you can save the scenario and download it to a InFusion device.

4.4.3 Sequences

The Global Rules are all you need for simple test scenarios. However, a scenario also can contain one or two sequences, which can define multiple states and allow branching between states. With a sequence, you also can do looping, which allows you to repeat a test state or to execute a test for a specified period of time.

As with Global Rules, the menu-driven interface guides you in building a sequence. Some of the prompts are different, however, because you now are encapsulating groups of events and actions as distinct states. Recall that a state is a combination of events and actions at a specific point in time. If the event or combined event defined by a state occurs, the corresponding action or set of actions follows.



Scenario Name: Test 328

Direction for traffic changes: From Initiator

Global Rules

Wait for SOF (from Initiator) <Click here to add combined event>

then Beep (500 ms) <Click here to add another action>

<Click here to add another event>

Sequence 0

State 0

Wait for CRC Error (from Initiator) <Click here to add combined event>

then Branch to 'State 1' <Click here to add another action>

<Click here to add another event>

Figure 4.10: Global Rules and Sequence Areas of a Scenario.

InFusion hardware provides the capacity to have up to two sequences co-existing in a scenario in addition to the Global Rules. Recall that both the Global Rules and any sequences are active at all times. Each is a separate “state machine,” having the behavior of a particular test state at any point in time. Because the Global Rules has the capacity for only one state, you can view it as a “degenerative state machine.”

4.5 Scenario Libraries

You can create any number of scenarios, which you then can archive on your PC hard drive. You also can download up to ten scenarios to each InFusion device for test execution. You can think of the libraries as windows that hold scenarios.

Recall that each library is a separate ***.infdb** file.

4.5.1 Main Library

When you launch the InFusion application, it opens a window called the Main Library. The main library is the default workspace for creating and storing new scenarios. The main library corresponds with the following file in the InFusion folder on the PC hard drive:

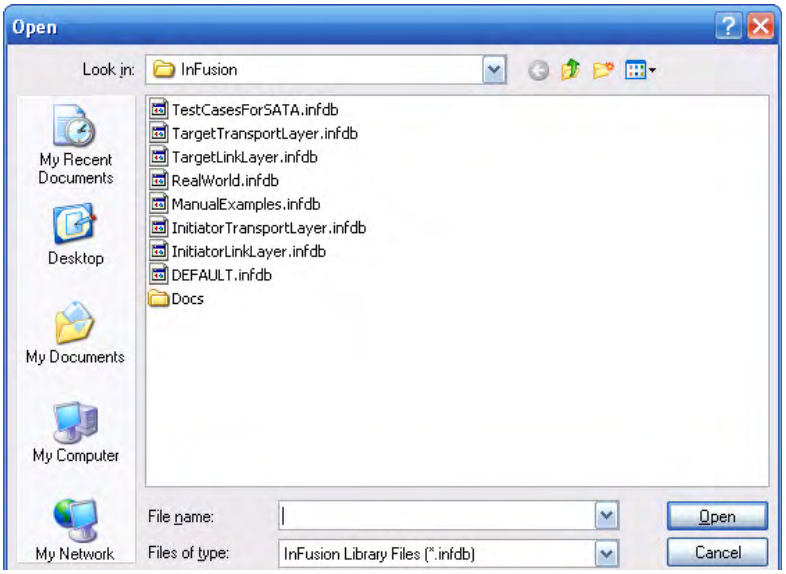
`default.infdb`

4.5.2 File Libraries

You can save the main library with a name other than default (while still using the **.infdb** file extension). The new file becomes a file library that is functionally equivalent to the main library with the following exception: It does not open by default in the Main Library window. You can navigate to other file libraries using the File Manager of the InFusion application.

In this manual, the main library and other **.infdb** file libraries are collectively called general libraries.

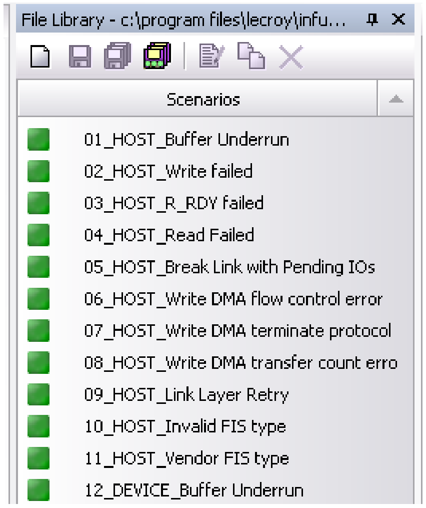
If you select **Open Library,** you see a window similar to the following:


Open
Look in:
InFusion
My Recent Documents
Desktop
My Documents
My Computer
My Network
File name:
Files of type:
InFusion Library Files (*.infdb)
Open
Cancel

TestCasesForSATA.infdb
TargetTransportLayer.infdb
TargetLinkLayer.infdb
RealWorld.infdb
ManualExamples.infdb
InitiatorTransportLayer.infdb
InitiatorLinkLayer.infdb
DEFAULT.infdb
Docs

Figure 4.11: Open Library File List.

By selecting the **TestCasesForSATA.infbd** file, you get an additional library window with predefined SATA test cases, similar to the following:


File Library - c:\program files\lecroy\infu...
Scenarios

🟩 01_HOST_Buffer Underrun
🟩 02_HOST_Write failed
🟩 03_HOST_R_RDY failed
🟩 04_HOST_Read Failed
🟩 05_HOST_Break Link with Pending IOs
🟩 06_HOST_Write DMA flow control error
🟩 07_HOST_Write DMA terminate protocol
🟩 08_HOST_Write DMA transfer count erro
🟩 09_HOST_Link Layer Retry
🟩 10_HOST_Invalid FIS type
🟩 11_HOST_Vendor FIS type
🟩 12_DEVICE_Buffer Underrun

Figure 4.12: Test Cases for SATA Library.

4.6 Scenario Properties

To begin the scenario creation process, you click the **New Scenario** button in a library window, the InFusion application toolbar or from the SAS SATA Protocol Suite Main Menu (see Figure 4.13) select Jammer (to get the InFusion dialog to popup see Figure 4.14).

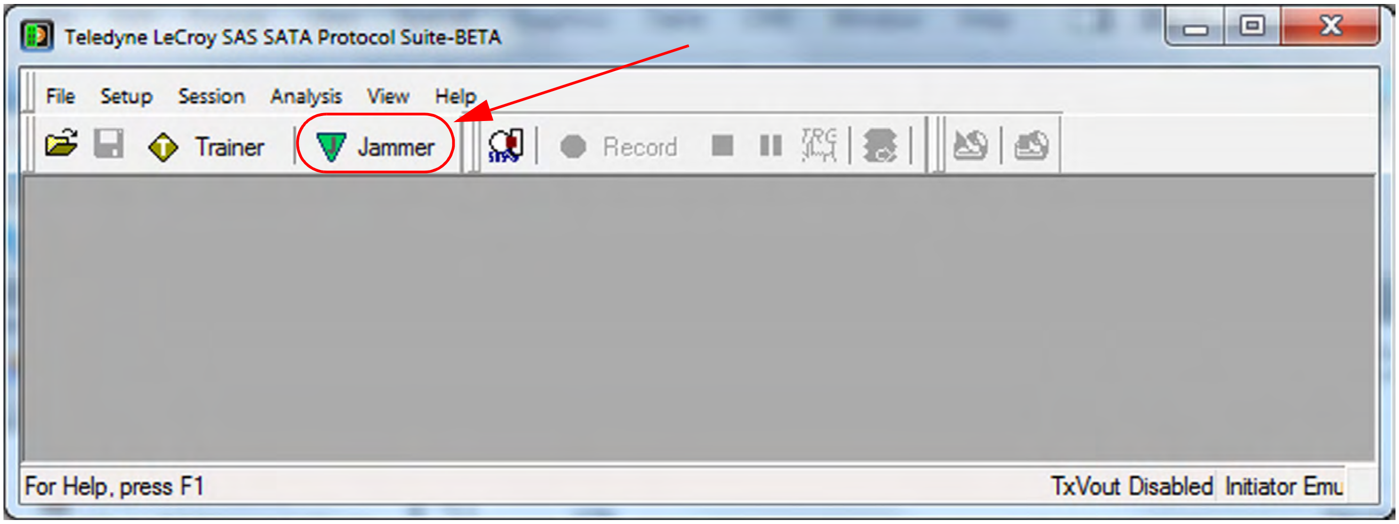

Teledyne LeCroy SAS SATA Protocol Suite-BETA
File
Setup
Session
Analysis
View
Help
Trainer
Jammer
Record
For Help, press F1
TxVout Disabled
Initiator Emu

Figure 4.13: SAS SATA Protocol Suite Main Menu

From the InFusion Dialog select the Create New Scenario icon (see Figure 4.14).

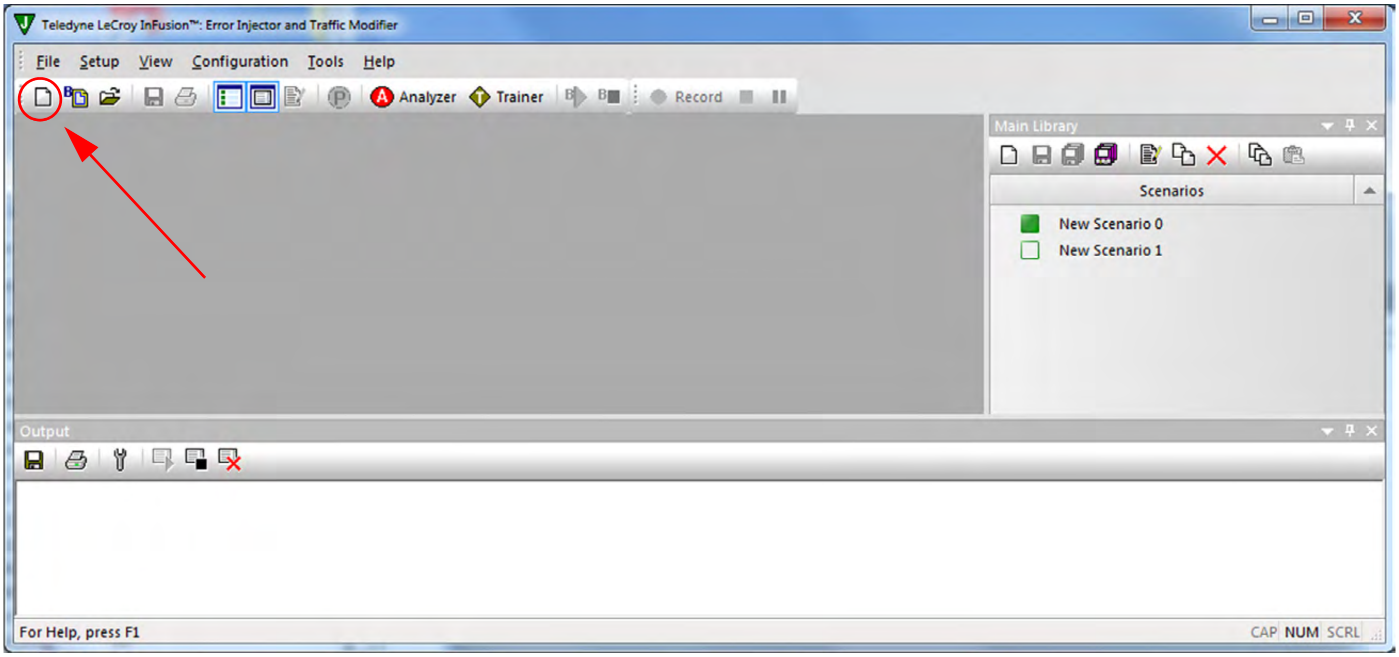
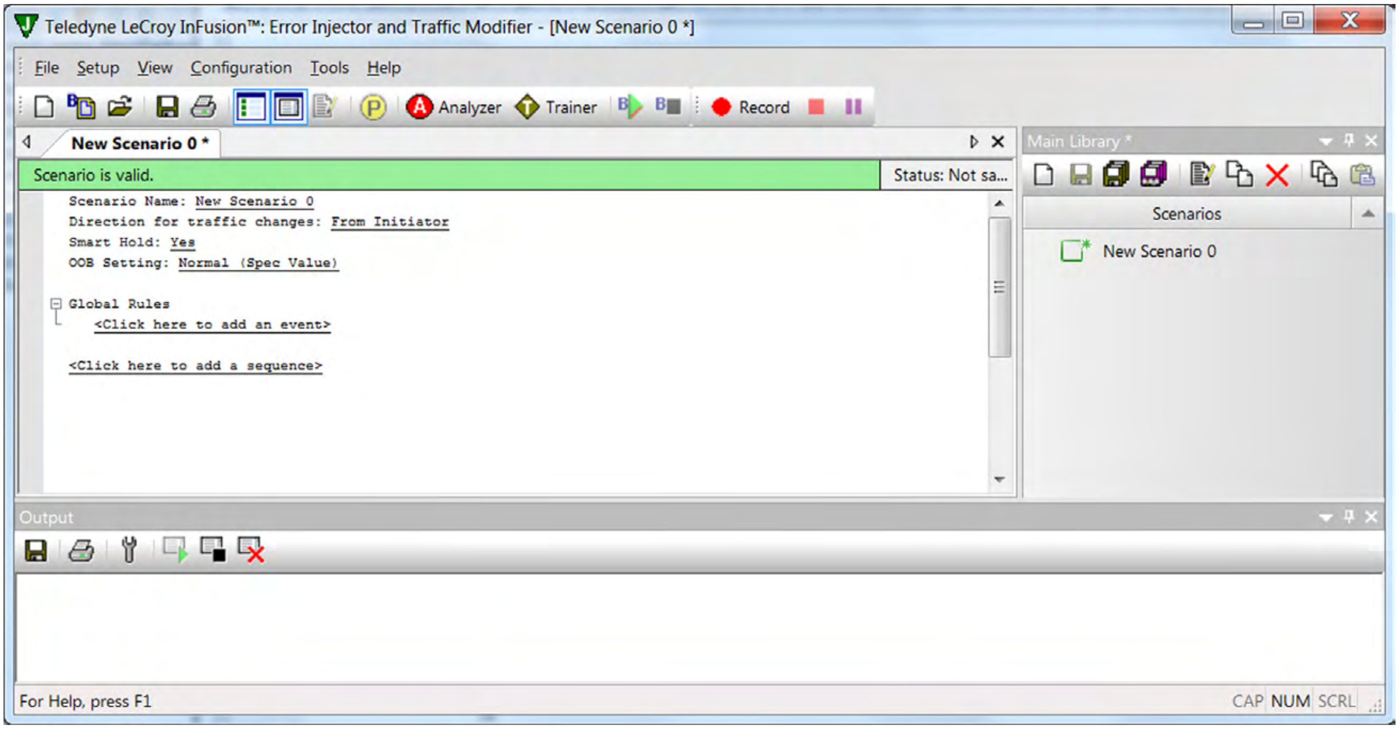

Teledyne LeCroy InFusion™: Error Injector and Traffic Modifier
File
Setup
View
Configuration
Tools
Help
Analyzer
Trainer
Record
Main Library
Scenarios
New Scenario 0
New Scenario 1
Output
For Help, press F1
CAP
NUM
SCRL

Figure 4.14: InFusion Dialog

The following New Scenario dialog pops up. See Figure 4.15 on page 298.


Teledyne LeCroy InFusion™: Error Injector and Traffic Modifier - [New Scenario 0 *]
File
Setup
View
Configuration
Tools
Help
Analyzer
Trainer
Record
New Scenario 0 *
Main Library *
Scenarios
New Scenario 0
Output
CAP NUM SCRL

Scenario is valid.

Status: Not sa...

```
Scenario Name: New Scenario 0
Direction for traffic changes: From Initiator
Smart Hold: Yes
OOB Setting: Normal (Spec Value)

Global Rules
   <Click here to add an event>

<Click here to add a sequence>
```

For Help, press F1

Figure 4.15: Structure of New Scenario 0

4.6.1 Scenario Generation

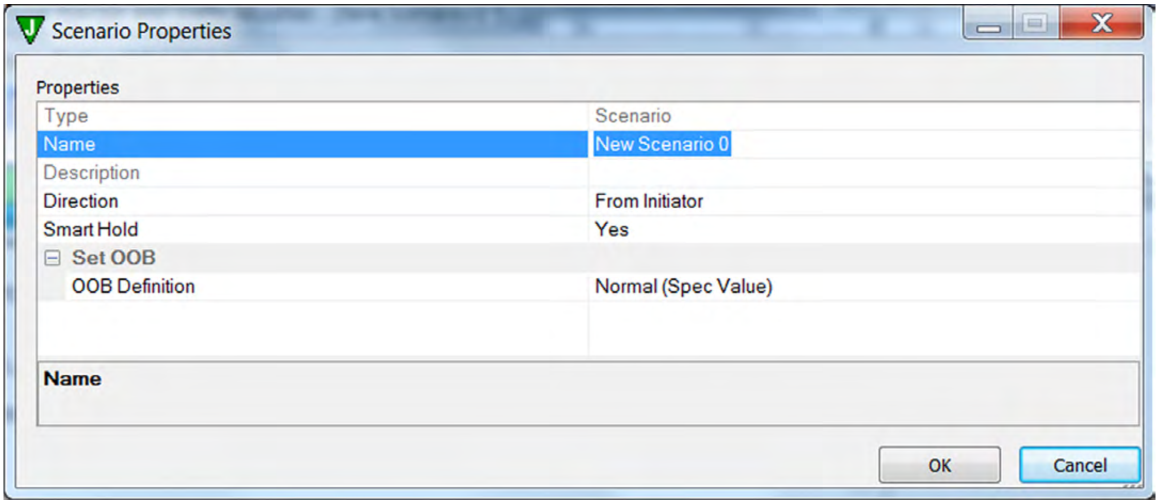
Your New Scenario 0 already has several Scenario Properties defined for it:

- ❑ Scenario Name: New Scenario 0
- ❑ Direction for traffic changes: From Initiator
- ❑ Smart Hold: Yes
- ❑ OOB Setting: Normal (Spec Value).

You can change any of these parameters by selecting them.

Scenario Name

Selecting Scenario Name allows you to customize it. See Figure 4.16.


Scenario Properties
OK
Cancel

Properties

Type	Scenario
Name	New Scenario 0
Description	
Direction	From Initiator
Smart Hold	Yes
⊟ Set OOB	
OOB Definition	Normal (Spec Value)

Name

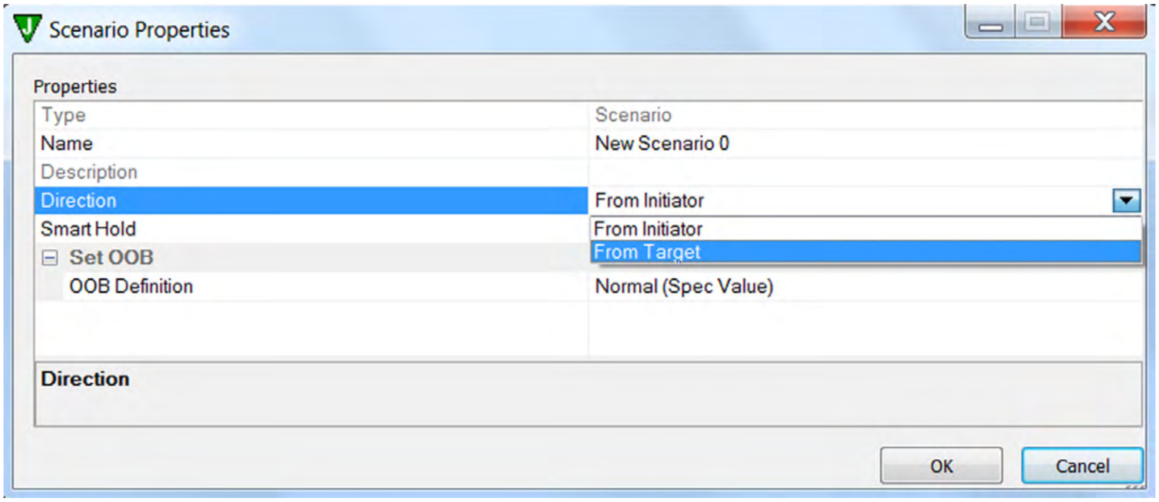
Figure 4.16: Scenario Properties: Name

Direction of Traffic

Selecting Direction allows you to change the Direction of Traffic. You identify direction of traffic change, or modification, in terms of traffic origin. The application uses the following conventions:

- ❑ **From Initiator**: Change is made to traffic coming from test host (for example, CRC error is injected into traffic stream sent from initiator to target).
- ❑ **From Target**: Modification is made to traffic coming from the target (for example, CRC error is injected into traffic stream sent from target to initiator).

The direction for traffic modification is defined on a global basis for the entire scenario. In other words, any scenario action that modifies line traffic only affects the traffic flowing in the direction established at the top of the scenario, in the Scenario Properties. Scenario events can be monitored in either direction, and therefore the parameters for events provide the ability to specify the intended direction for monitoring traffic for that event. See Figure 4.17.

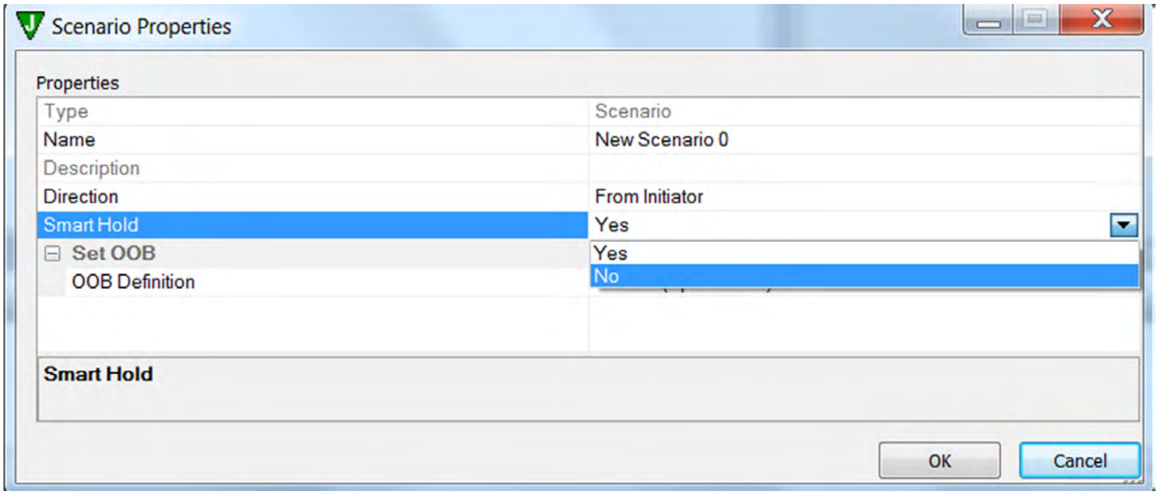


Type	Scenario
Name	New Scenario 0
Description	
Direction	From Initiator
Smart Hold	
⊟ Set OOB	
OOB Definition	Normal (Spec Value)

Figure 4.17: Scenario Properties: Direction of Traffic

Smart Hold

SATA Scenario Properties have a Smart Hold option, which is on by default. Figure 4.18 on page 300.



Type	Scenario
Name	New Scenario 0
Description	
Direction	From Initiator
Smart Hold	Yes Yes No
⊟ Set OOB	
OOB Definition	

Smart Hold

Figure 4.18: Scenario Properties: Smart Hold

Each port monitors incoming data, which originated with the other device’s receiver, as close as possible to where it enters the bus engine. If a port detects a HOLD primitive during a SATA frame, the port stops reading data from the FIFO and generates HOLDA. The HOLD propagates through the bus engine and eventually goes to the other device, where the HOLD causes the other device to send HOLDA. (The bus engine FIFOs must be deep enough to hold all the traffic that the other device sends while the HOLD propagates. The port drops all incoming HOLDA conditions, so HOLDAs are never put in the FIFOs or made visible to the sequencers.)

After this, the port that had been receiving the HOLD stops sending HOLDA and attempts to read data from the FIFO. The termination of HOLD propagates through the bus engine and then causes the other device to restart transmission, which puts data into the FIFO.

Note: If both sides send HOLD primitives that overlap, the receivers drop the HOLD conditions to avoid overflowing the FIFOs. If you turn off the Smart Hold option, the port does not send HOLDA when it detects a HOLD primitive during a SATA frame.

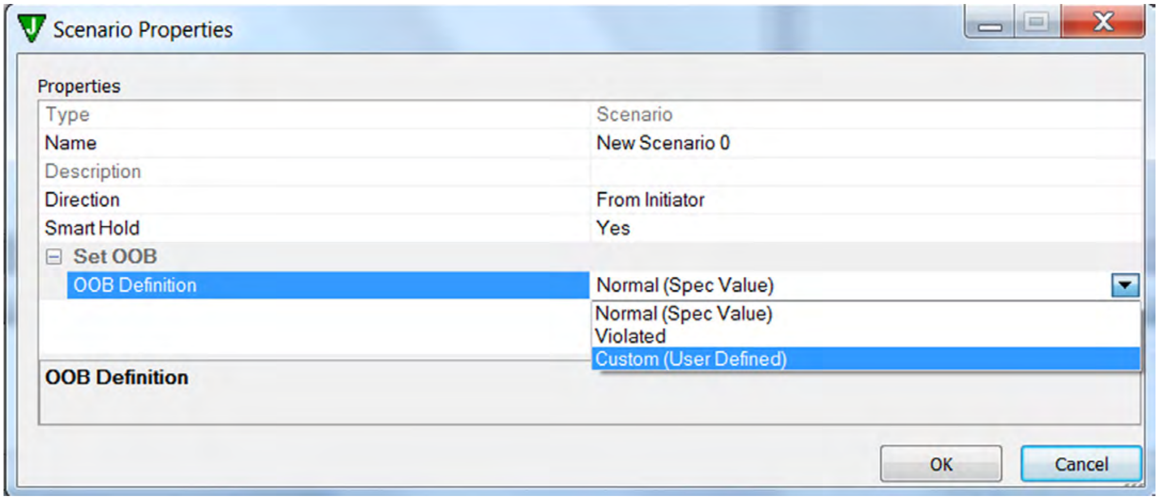
OOB Definition

Select OOB Definition to set the Out of Band conditions. You have three choices (see Figure 4.19 on page 301):

- Normal (Spec Value)
- Violated
- Custom (User Defined)

Normal uses Spec Values for OOB conditions.

Normal (Spec Value)

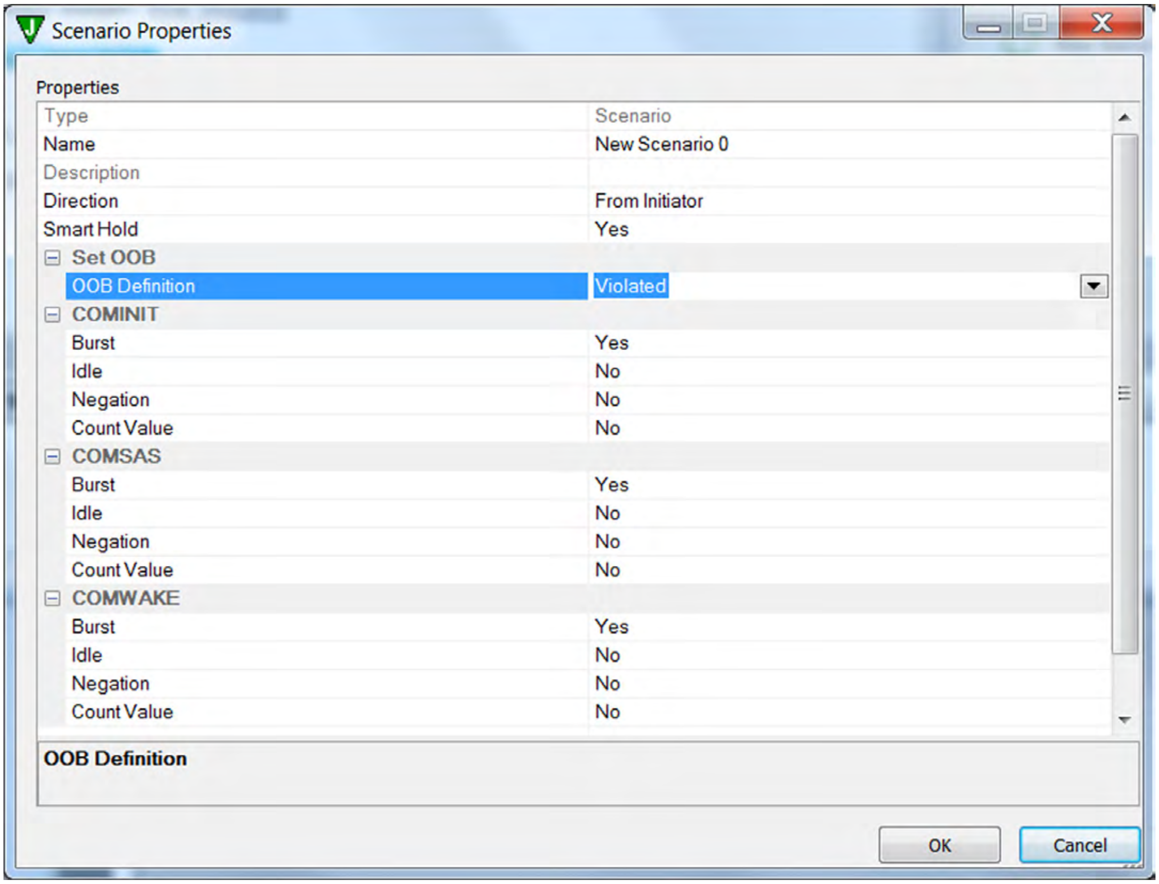

Scenario Properties
Properties
Normal (Spec Value)
Violated
Custom (User Defined)
OOB Definition
OK
Cancel

Type	Scenario
Name	New Scenario 0
Description	
Direction	From Initiator
Smart Hold	Yes
⊟ Set OOB	
OOB Definition	Normal (Spec Value)

Figure 4.19: Scenario Properties: OOB Definition

Violated

You can set the COMINT, COMSAS or COMWAKE parameters that would cause an OOB condition by selecting Violated and selecting Yes or No. See Figure 4.20.

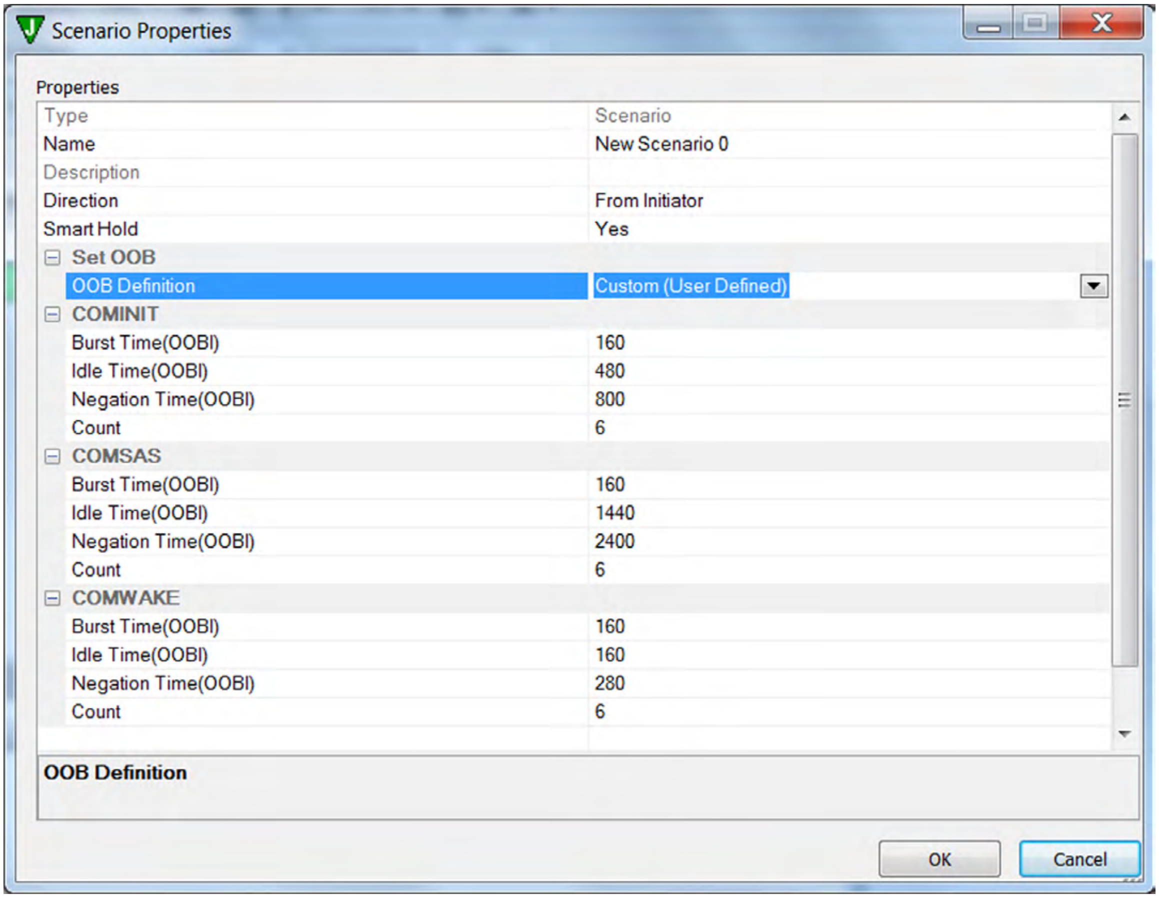

Scenario Properties
Properties
OOB Definition
OK
Cancel

Type	Scenario
Name	New Scenario 0
Description	
Direction	From Initiator
Smart Hold	Yes
⊟ Set OOB	
OOB Definition	Violated
⊟ COMINIT	
Burst	Yes
Idle	No
Negation	No
Count Value	No
⊟ COMSAS	
Burst	Yes
Idle	No
Negation	No
Count Value	No
⊟ COMWAKE	
Burst	Yes
Idle	No
Negation	No
Count Value	No

Figure 4.20: Scenario Properties: OOB Violated Conditions

Custom (User Defined)

Or you can generate your own set of Conditions for an Out of Bounds conditions: Custom (User Defined). See Figure 4.21.



Type	Scenario
Name	New Scenario 0
Description	
Direction	From Initiator
Smart Hold	Yes
Set OOB	
OOB Definition	Custom (User Defined)
COMINIT	
Burst Time(OOBI)	160
Idle Time(OOBI)	480
Negation Time(OOBI)	800
Count	6
COMSAS	
Burst Time(OOBI)	160
Idle Time(OOBI)	1440
Negation Time(OOBI)	2400
Count	6
COMWAKE	
Burst Time(OOBI)	160
Idle Time(OOBI)	160
Negation Time(OOBI)	280
Count	6

OOB Definition

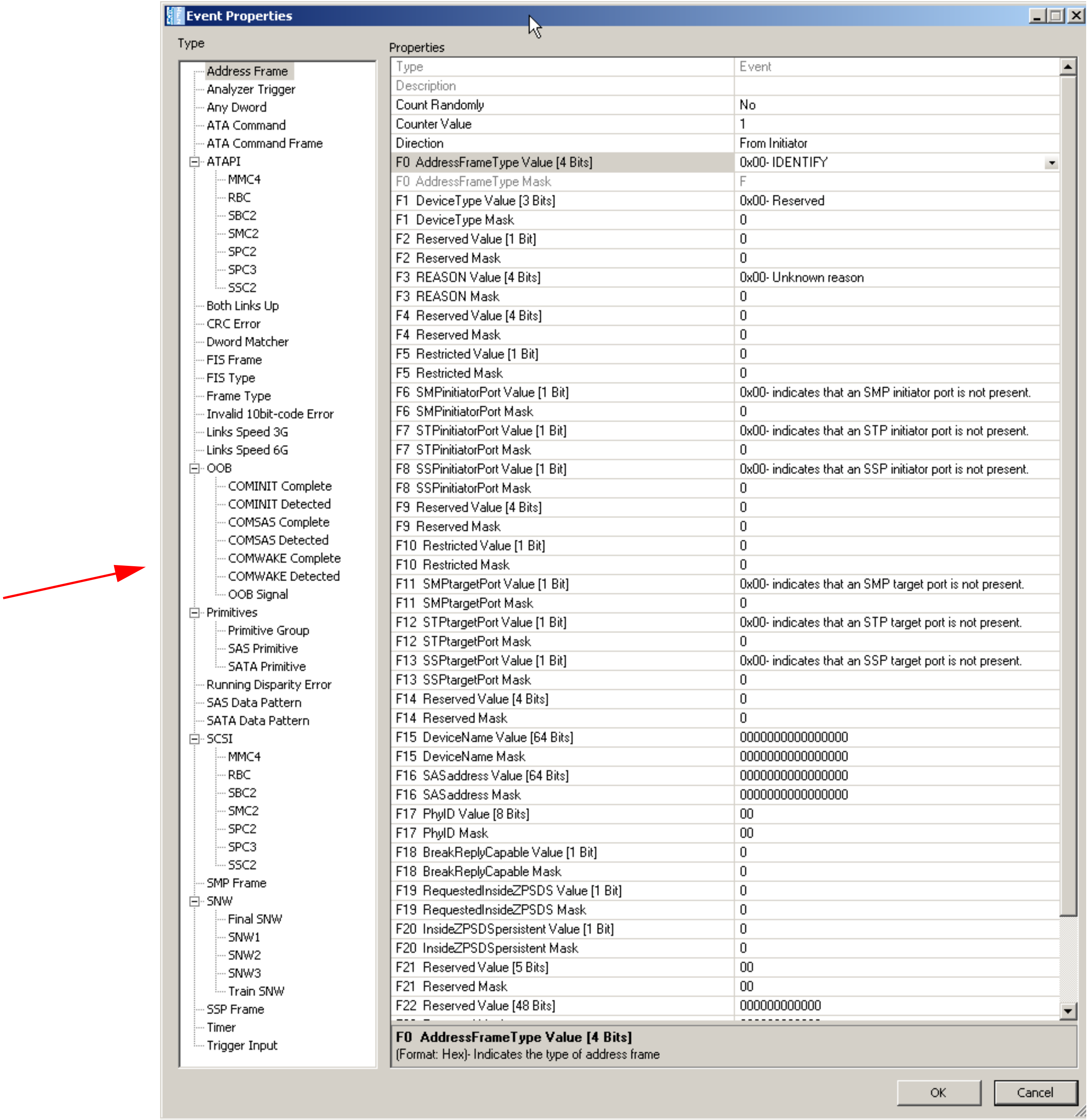
Figure 4.21: Scenario Properties: OOB Custom Conditions

This allows you to set the values for each parameter type (COMINIT, COMSAS, and COMWAKE).

The next step is to define the Scenario Events and Actions.

4.7 Scenario Events

A scenario is a script you create using simple mouse clicks and text entries. As you work, the script takes shape in the scenario area of the application display. You can think of the scenario area itself as consisting of two subareas: A Global Rules area at the top, where you create the Global Rules, and a Sequence area beneath the Global Rules, where you create any sequences. Whether you are creating Global Rules or a Sequence, the menu-driven interface prompts you to specify the event(s) for which you want to trigger actions (see Figure 4.24 on page 308).


Event Properties
Type
Address Frame
Analyzer Trigger
Any Dword
ATA Command
ATA Command Frame
ATAPI
MMC4
RBC
SBC2
SMC2
SPC2
SPC3
SSC2
Both Links Up
CRC Error
Dword Matcher
FIS Frame
FIS Type
Frame Type
Invalid 10bit-code Error
Links Speed 3G
Links Speed 6G
OOB
COMINIT Complete
COMINIT Detected
COMSAS Complete
COMSAS Detected
COMWAKE Complete
COMWAKE Detected
OOB Signal
Primitives
Primitive Group
SAS Primitive
SATA Primitive
Running Disparity Error
SAS Data Pattern
SATA Data Pattern
SCSI
MMC4
RBC
SBC2
SMC2
SPC2
SPC3
SSC2
SMP Frame
SNW
Final SNW
SNW1
SNW2
SNW3
Train SNW
SSP Frame
Timer
Trigger Input
Properties
OK
Cancel

Type	Event
Description	
Count Randomly	No
Counter Value	1
Direction	From Initiator
F0 AddressFrameType Value [4 Bits]	0x00- IDENTIFY
F0 AddressFrameType Mask	F
F1 DeviceType Value [3 Bits]	0x00- Reserved
F1 DeviceType Mask	0
F2 Reserved Value [1 Bit]	0
F2 Reserved Mask	0
F3 REASON Value [4 Bits]	0x00- Unknown reason
F3 REASON Mask	0
F4 Reserved Value [4 Bits]	0
F4 Reserved Mask	0
F5 Restricted Value [1 Bit]	0
F5 Restricted Mask	0
F6 SMPinitiatorPort Value [1 Bit]	0x00- indicates that an SMP initiator port is not present.
F6 SMPinitiatorPort Mask	0
F7 STPinitiatorPort Value [1 Bit]	0x00- indicates that an STP initiator port is not present.
F7 STPinitiatorPort Mask	0
F8 SSPinitiatorPort Value [1 Bit]	0x00- indicates that an SSP initiator port is not present.
F8 SSPinitiatorPort Mask	0
F9 Reserved Value [4 Bits]	0
F9 Reserved Mask	0
F10 Restricted Value [1 Bit]	0
F10 Restricted Mask	0
F11 SMPtargetPort Value [1 Bit]	0x00- indicates that an SMP target port is not present.
F11 SMPtargetPort Mask	0
F12 STPtargetPort Value [1 Bit]	0x00- indicates that an STP target port is not present.
F12 STPtargetPort Mask	0
F13 SSPtargetPort Value [1 Bit]	0x00- indicates that an SSP target port is not present.
F13 SSPtargetPort Mask	0
F14 Reserved Value [4 Bits]	0
F14 Reserved Mask	0
F15 DeviceName Value [64 Bits]	0000000000000000
F15 DeviceName Mask	0000000000000000
F16 SASaddress Value [64 Bits]	0000000000000000
F16 SASaddress Mask	0000000000000000
F17 PhyID Value [8 Bits]	00
F17 PhyID Mask	00
F18 BreakReplyCapable Value [1 Bit]	0
F18 BreakReplyCapable Mask	0
F19 RequestedInsideZPSDS Value [1 Bit]	0
F19 RequestedInsideZPSDS Mask	0
F20 InsideZPSDSpersistent Value [1 Bit]	0
F20 InsideZPSDSpersistent Mask	0
F21 Reserved Value [5 Bits]	00
F21 Reserved Mask	00
F22 Reserved Value [48 Bits]	000000000000

F0 AddressFrameType Value [4 Bits]
(Format: Hex)- Indicates the type of address frame

Figure 4.22: Event Properties Dialog.

While many events are line conditions, an event also can be a condition that occurs within a InFusion device (for example, detection of a trigger signal from another device).
The following table lists supported events. Note that some events are applicable only in the context of creating sequences (those events appear on the drop-down list only if you are creating a sequence). Sequences can have multiple states, and they allow branching between states.

TABLE 4.2: Events

Event	Description
Address Frame	Occurrence of a specified address frame.
Analyzer Trigger	Trigger on Analyzer when its event matches. You can see the trigger on the Status Bar, but the Port Status dialog does not display any mark in the Trigger column. **Note**: This is different than the external trigger mechanism. You do not need an external trigger cable. **Note**: The Trigger on Analyzer feature functions when the trigger pattern is set to "Pattern/Infusion" and running a scenario which will trigger analyzer after a 5s timer. A message "Triggered, Post-Trig Capturing" displays on the Software Status bar. **Note**: When the analyzer triggers, it triggers on a packet before the actual trigger event occurs. The trace triggers more than 1us before the event actually occurs. The trigger is on the Initiator side instead of the Target side as set in the scenario.
Any DWORD	Occurrence of any DWORD.
ATA Command	Occurrence of a particular ATA command.
ATA Command Frame	Occurrence of a particular ATA command frame.
[+] ATAPI	Occurrence of a particular ATAPI command from the list: MMC4, RBC, SBC2, SMC2, SPC2, SPC3, or SSC2.
Both Links Up	Occurrence of both line ports active (not idling).
CRC Error	Occurrence of a CRC error.
DWORD Matcher	Occurrence of a particular DWORD.
FIS Frame	Occurrence of a particular FIS frame.
FIS Type	Occurrence of a particular SATA FIS type.
Frame Type	Occurrence of a particular frame type.
Invalid 10bit-code Error	Occurrence of an invalid 10b code.
Links Speed 3G	Both lines operating at 3 Gbps.
Links Speed 6G	Both lines operating at 6 Gbps.
Links Speed 12G	Both lines operating at 12 Gbps.
OOB Signal	Occurrence of OOB signal.
[+] Primitives	Occurrence of Primitive Group, SAS Primitive, or SATA Primitive. Includes NOT property (see Figure 4.23 on page 307).
Running Disparity Error	Occurrence of Running Disparity (RD) error.
SAS Data Pattern	Occurrence of a particular data pattern in a SAS frame.
SATA Data Pattern	Occurrence of a particular data pattern in a SATA frame.
{+} SCSI	Occurrence of a particular SCSI command from the list: MMC4, RBC, SBC2, SMC2, SPC2, SPC3, or SSC2.

Event	Description
SMP Frame	Occurrence of a particular SMP frame.
SNW	Occurrence of Final SNW, SNW1, SNW2, SNW3, Train SNW
SSP Frame	Occurrence of a particular SSP frame.
Timer	Occurrence of a particular elapsed time (time period).
Training Sequence	Occurrence after Training Sequence.
Trigger Input	Occurrence of input trigger.

The following sections provide some additional details about three of the above events.

4.7.1 DWORD Matcher

DWORD Matcher is a DWORD pattern matcher that presents match and mask fields and a K-Code Mask field. K-Codes are control characters that are always used in the first byte of a four-byte primitive. Of the K-Code masks listed in the menu, D-D-D-D is used for data bytes, and K-D-D-D is used for all primitives.

When you create a DWORD match, keep the following in mind:

- ☐ The pattern can be inside or outside of frames (it does not matter if the pattern is inside a frame or not).
- ☐ Because the pattern can be inside or outside of frames, there is no offset.
- ☐ You can make user-defined primitives. (This is the reason this feature was created.)
- ☐ You can use any K/D pattern.

4.7.2 Address Frame

With Infusion, you must enter all values in reverse MSB, LSB order.

For example: a SAS Address in the viewer "5000C50056B8C829" should be entered like this in Infusion: "29C8B85600C50050".

4.7.3 SAS Data Pattern

When you create a SAS data pattern, keep the following in mind:

- ☐ The pattern must be defined inside a frame that starts with a SOF or SOAF.
- ☐ The pattern must be data only (no K-codes/primitives).
- ☐ The pattern must be defined at a specific offset in the frame.
- ☐ The pattern and mask must be specified in the same format as specified in the SAS standard:
  0x12345678 (hex)
  where “1” is the first digit on the cable and is the MSB as given in the SAS Standard.

For example, for an SMP Request:

```
Pattern: 0x40000000
Mask: 0xFF000000
Offset: 0
```

```
SOF Type: SOF
```

4.7.4 SATA Data Pattern

When you create a SATA data pattern, keep the following in mind:

- ☐ The pattern must be defined inside a frame that starts with a SATA_SOF.
- ☐ The pattern must be data only (no K-codes/primitives).
- ☐ The pattern must be defined at a specific offset in the frame.
- ☐ The pattern and mask must be specified in the same format as specified in the SATA Standard.

For example, for Register H -> D FIS:

```
Pattern: 0x00000027
Mask: 0x000000FF
Offset: 0
SOF Type: SATA_SOF
```

4.7.5 Analyzer Trigger

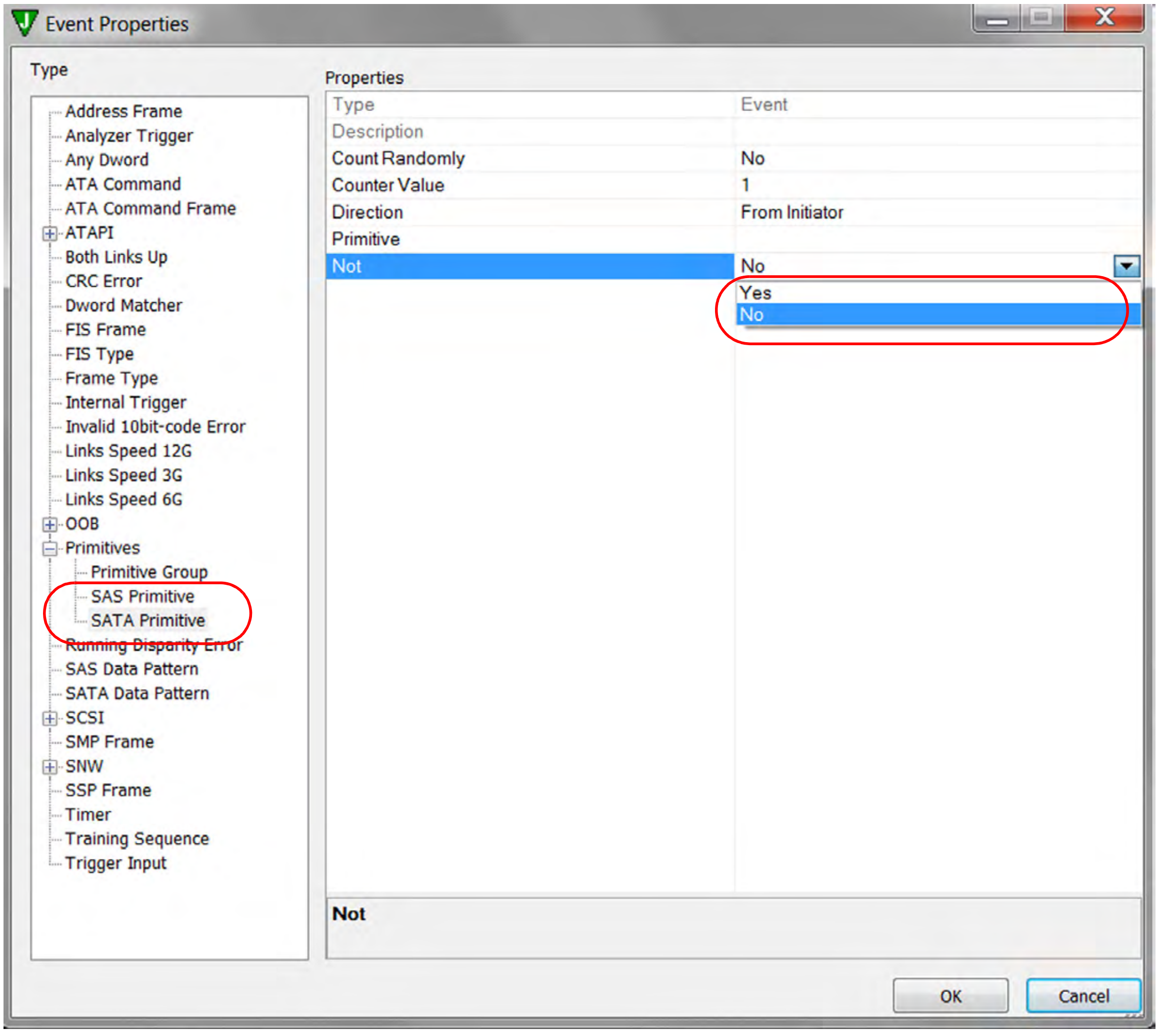
Trigger the Analyzer when the Scenario event matches. You can see the trigger on the Analyzer Status Bar.

The Analyzer Trigger feature functions when the Analyzer trigger pattern is set to **Pattern/Infusion** and is running a scenario which activates the **Trigger analyzer** action. A message **Triggered, Post-Trig Capturing** displays on the Software Status bar.

This is different from the external trigger mechanism. You do not need an external trigger cable.

When the analyzer triggers, it triggers on a packet before the actual trigger event occurs. The trace triggers more than 1 µs before the event actually occurs. The trigger is on the Initiator side instead of the Target side, as set in the scenario.

4.7.6 Adding NOT Property to SAS and SATA Primitives


Event Properties
Type
Address Frame
Analyzer Trigger
Any Dword
ATA Command
ATA Command Frame
ATAPI
Both Links Up
CRC Error
Dword Matcher
FIS Frame
FIS Type
Frame Type
Internal Trigger
Invalid 10bit-code Error
Links Speed 12G
Links Speed 3G
Links Speed 6G
OOB
Primitives
Primitive Group
SAS Primitive
SATA Primitive
Running Disparity Error
SAS Data Pattern
SATA Data Pattern
SCSI
SMP Frame
SNW
SSP Frame
Timer
Training Sequence
Trigger Input
Properties
Yes
No
OK
Cancel

Type	Event
Description	
Count Randomly	No
Counter Value	1
Direction	From Initiator
Primitive	
Not	No

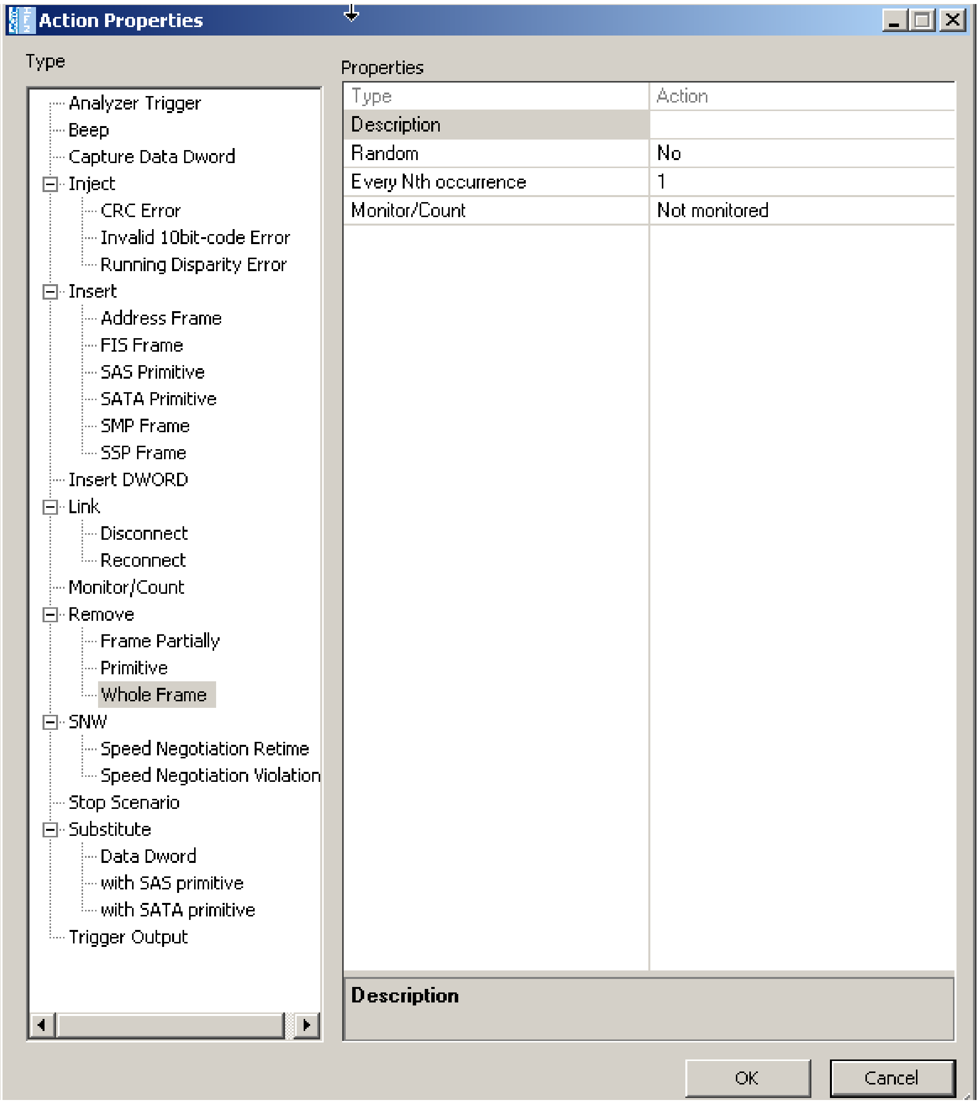
Not

Figure 4.23: Event Properties: Not

Use the Not property to look for a de-asserted Primitive.

4.8 Scenario Actions

After you enter the set of events for a test state, the menu-driven interface prompts you for the corresponding action or set of actions. If you define multiple actions, the actions occur simultaneously.


Action Properties
Type
Analyzer Trigger
Beep
Capture Data Dword
Inject
CRC Error
Invalid 10bit-code Error
Running Disparity Error
Insert
Address Frame
FIS Frame
SAS Primitive
SATA Primitive
SMP Frame
SSP Frame
Insert DWORD
Link
Disconnect
Reconnect
Monitor/Count
Remove
Frame Partially
Primitive
Whole Frame
SNW
Speed Negotiation Retime
Speed Negotiation Violation
Stop Scenario
Substitute
Data Dword
with SAS primitive
with SATA primitive
Trigger Output
Properties
Description
OK
Cancel

Type	Action
Description	
Random	No
Every Nth occurrence	1
Monitor/Count	Not monitored

Figure 4.24: Action Properties Dialog

The following table lists supported actions. Note that some of these actions only apply to creating sequences.

TABLE 4.3: Test State Actions

Action		Description
Analyzer Trigger		The Jammer sends a trigger to the Analyzer.
Beep		Emits audible sound of duration selectable via drop-down list.
Capture Data DWORD		Captures a data DWORD into one of four registers.
Inject	CRC Error	Injects a CRC error into the line.
	Invalid 10bit-code Error	Injects invalid 10b code into the line.
	Running Disparity Error	Injects a Running Disparity (RD) error into traffic.
Insert	Address Frame FIS Frame SAS Primitive SATA Primitive SMP Frame SSP Frame	Inserts a frame or primitive.
Insert DWORD		Inserts DWORD.
Internal Trigger		Allows user to send a trigger (notification) to other ports. See "Generating an Internal Trigger" on page 314.
Link	Disconnect	Puts both InFusion SAS ports at electrical idle immediately. This action is only in effect while the scenario is running, and the Jammer will reconnect the line when the scenario is stopped.
	Reconnect	Starts traffic pass-through immediately. This action restarts traffic after a previous disconnect command. Once traffic is passing through, the initiator and target resume OOB signaling.
Marker		The main purpose of this feature is enabling the user to mark specific parts of the captured traffic for better tracking. See "Generating a Jammer Marker" on page 316.
Monitor/Count		Opens a window to count the number of events that occur during a session. A session is a time interval during which a scenario runs.
Remove	Frame Partially Whole Frame	Removes the targeted event from the traffic.In InFusion. A Remove primitive action is implemented by replacing the primitive with an idle data DWORD. A Remove frame action is implemented by replacing the start-of-frame and end-of-frame primitives with an idle data DWORD.

Action		Description
Restart	All Sequences[1]	Restart all sequences in the scenario.[1]
	Current Sequence[1]	Restart the sequence that contains this action definition. [1]
SNW	Speed Negotiation Retime	Set RCDT, SNTT, ALT/TLT, TX speed, TRAIN/ TRAIN_DONE pattern, and/or PHY Capability.
	Speed Negotiation Violation	Set Violation Type.
Stop Scenario		Stops all scenario activity.
Substitute	Data DWORD	Substitutes a data DWORD in the traffic.
	with SAS Primitive	Substitutes a SAS primitive in the traffic.
	with SATA Primitive	Substitutes a SATA primitive in the traffic.
Trigger Output		Sends a signal out the trigger port to the device downstream. The trigger point in the Analyzer that caused the analyzer trigger action will not be the selected event, it will be the selected event with some offset.

[1] Only shown in Action Properties dialog box when creating a sequence.

4.8.1 Available Resources

You can specify Events, Combined Events and Actions and additional Events. The application automatically checks for the maximum number of terms (Events/Actions). When you exceed the limit, an error is flagged, prompting you to jump to the place that caused the error.

The list of available resources is given below:

- External Trigger X 1
- Analyzer Trigger X 1
- Training Detector x 4 (only M12x)
- Primitive Detector (each has its own Embedded counter in M12x) X 8
- Pattern Detector (each has its own Embedded counter in M12x) X 8 (a total of 12 DWORD detectors are shared between all pattern detectors)
- Frame Type Detector X 24
- Counter X 12
- Timer X 8
- OOB X 1
- ComWakeDetected X 1
- ComWakeCompleted X 1
- ComInitDetected X 1
- ComInitCompleted X 1
- ComSasDetected X 1
- ComSasCompleted X 1
- Snw1 X 1

- Snw2 X 1
- Snw3 X 1
- SnwFinal X 1
- SnwTrain X 1
- DisparityError X 1
- 10B Error X 1
- CrcError X 1
- Both Links Up X 1
- Link Speed 3G X 1
- Link Speed 6G X 1
- Link Speed 12G X 1
- Primitive Substitute X 12
- Insert Frame1 (Up To 1024 Dword) X 1
- Insert Dword8 (Up To 16 Dword) X 8
- SNW Manipulation X 16
- Global Action Register X 8
- State per sequencer X 256
- Action Register per state X 8

Usage of Action Register:

- Each Counter in Global Rules = 2
- Each Counter in State = 3
- Each Timer in Global Rules = 2
- Each Timer in State = 3
- Other Actions = 1

4.8.2 Using Counters in Events and Actions

Many of the events and actions supported by InFusion also support counters that can control functions.

Within events, counters determine how many times the event must occur before the associated actions are triggered. Event counters typically have two properties:

- **Count Randomly**: Can be set to “Yes” or “No” (default value is “No”).
  If set to “Yes”, the event repeats a random number of times (between 1 and the value set in the property **Max Random Count**, which replaces the property **Counter Value** when “Yes” is selected), before the action is triggered.
- **Counter Value**: Number of repeats required when **Count Randomly** is set to “No”. The default value is 1.

Within actions, counters determine how many times the system calls the action before it acts. Action counters typically have two properties:

- **Random**: Can be set to “Yes” or “No” (default value is “No”).
  If set to “Yes”, the action triggers a number of occurrences before the action takes place. That number ranges randomly between 1 and the value set in the property **At least every Nth occurrence**, which replaces the property **Every Nth occurrence** when “Yes” is selected.
- **Every Nth occurrence**: Number of times the system calls the action before it acts.

Note that there is some overlap in the way these counters can be used. For example, in the simple case of a single event leading to a single action, it makes no difference whether you specify the event to require five repeats before triggering the action, or the action to require five occurrences before it acts.

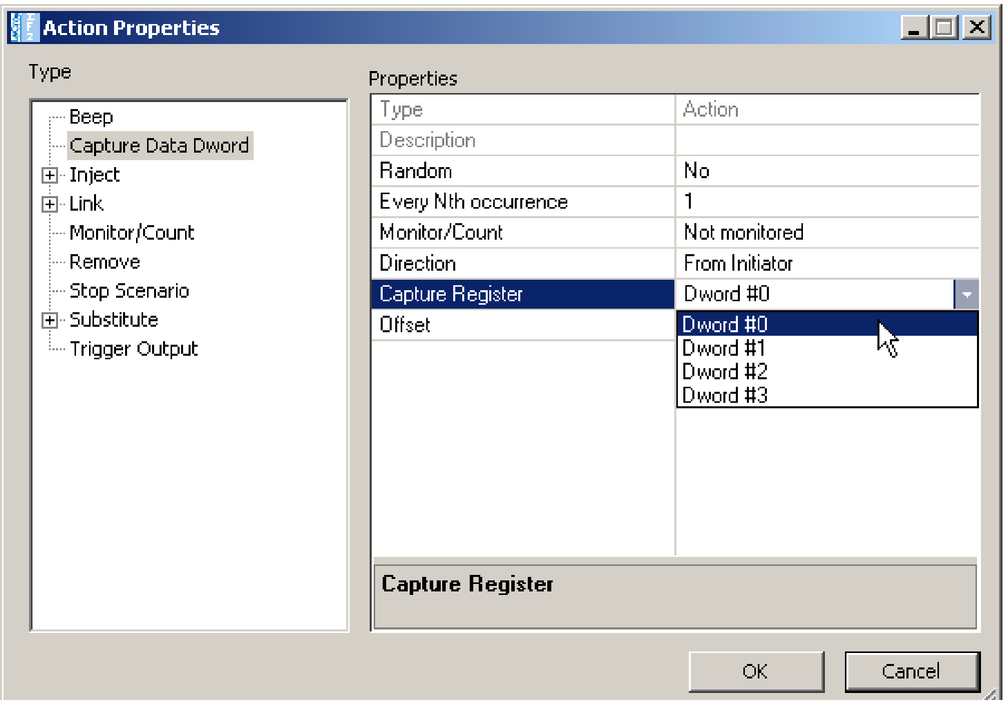
However, in the case of combined events and/or actions, the separate counters provide flexibility in designing test cases. For example, consider the case where Event_1 OR Event_2 leads to Action. If Event_1 has a counter of 5, then the Action triggers either when Event_1 has repeated five times or when Event_2 happens the first time, whichever occurs first.

But if the event counters are set to 1 and the Action counter is set to 5, then the Action happens after five occurrences of EITHER Event_1 or Event_2.

4.8.3 Capturing a Data DWORD

InFusion provides the ability to capture individual data DWORDs and provides four different registers to store captured DWORDs (DWORD #0, #1, #2 and #3).

To capture a data DWORD, select **Capture Data DWORD** from the Action Properties screen, as shown below. Select the register to be used to store the DWORD from the drop-down menu under the **Capture Register** property.


Action Properties
Type
Beep
Capture Data Dword
Inject
Link
Monitor/Count
Remove
Stop Scenario
Substitute
Trigger Output
Properties
Dword #0
Dword #1
Dword #2
Dword #3
Capture Register
OK
Cancel

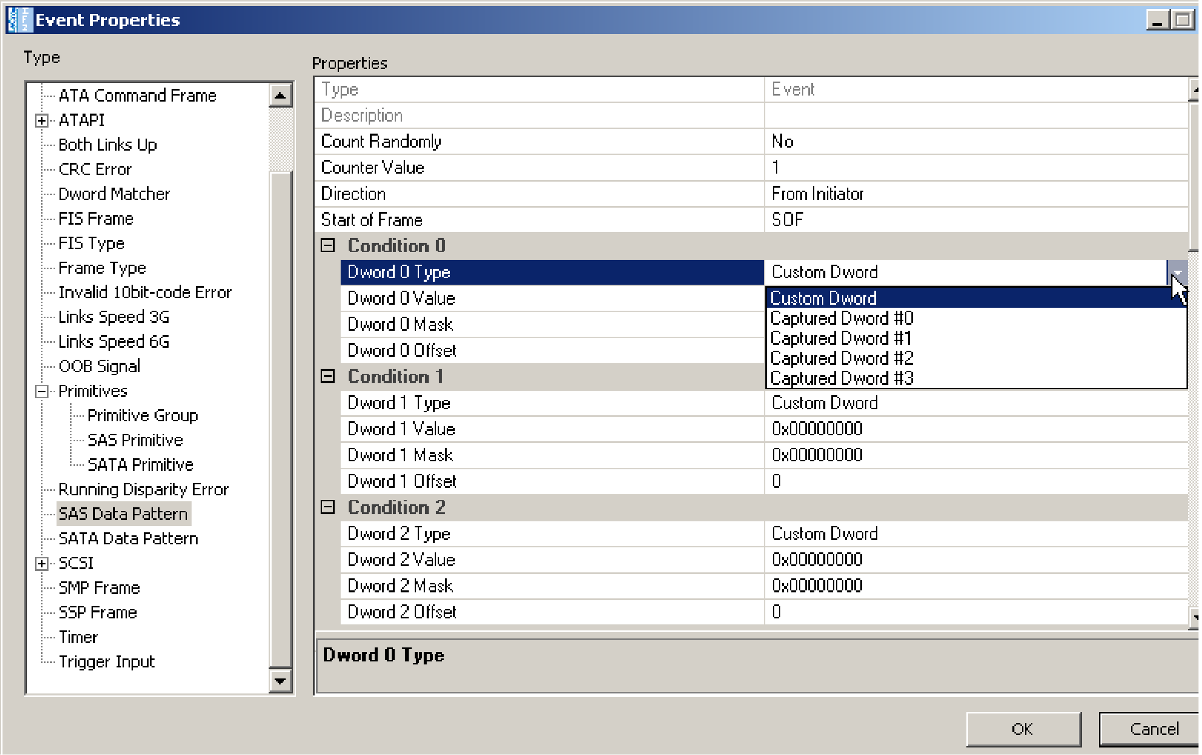
Type	Action
Description	
Random	No
Every Nth occurrence	1
Monitor/Count	Not monitored
Direction	From Initiator
Capture Register	Dword #0
Offset	

Figure 4.25: Capture Data DWORD Action

4.8.4 Using Captured Data DWORDs

Captured data DWORDs can be used in creating events for data that match the captured DWORD(s), or in creating actions to substitute the captured DWORD(s) into the data stream.

To create an event using the captured DWORD, in the Event Properties menu, select **SAS Data Pattern** (or **SATA Data Pattern**), and then select any of the 12 DWORDs (**DWORD 0 Type** through **DWORD 11 Type**). The drop-down menu provides the choice of a custom DWORD or any of the four captured DWORDs (see Figure 4.26 on page 313). If you select a captured DWORD, the **Value** field beneath this selection is hidden (the **Value** field is only used for specifying custom DWORDs). Note that choice of a mask and an offset are still available when using captured DWORDs.

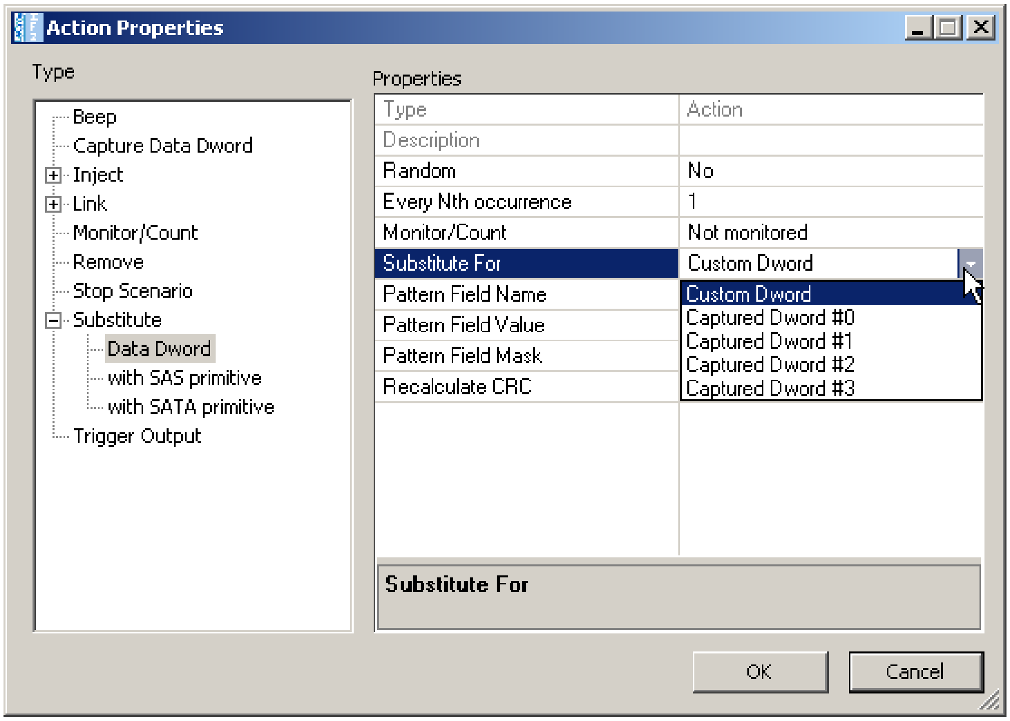

Event Properties
Type
ATA Command Frame
ATAPI
Both Links Up
CRC Error
Dword Matcher
FIS Frame
FIS Type
Frame Type
Invalid 10bit-code Error
Links Speed 3G
Links Speed 6G
OOB Signal
Primitives
Primitive Group
SAS Primitive
SATA Primitive
Running Disparity Error
SAS Data Pattern
SATA Data Pattern
SCSI
SMP Frame
SSP Frame
Timer
Trigger Input
Properties
Custom Dword
Captured Dword #0
Captured Dword #1
Captured Dword #2
Captured Dword #3
OK
Cancel

Type	Event
Description	
Count Randomly	No
Counter Value	1
Direction	From Initiator
Start of Frame	SOF
⊟ Condition 0	
Dword 0 Type	Custom Dword
Dword 0 Value	
Dword 0 Mask	
Dword 0 Offset	
⊟ Condition 1	
Dword 1 Type	Custom Dword
Dword 1 Value	0x00000000
Dword 1 Mask	0x00000000
Dword 1 Offset	0
⊟ Condition 2	
Dword 2 Type	Custom Dword
Dword 2 Value	0x00000000
Dword 2 Mask	0x00000000
Dword 2 Offset	0

Dword 0 Type

Figure 4.26: Using a Captured DWORD in a SAS Data Pattern

Captured data DWORDs may also be used in the **Substitute Data DWORD** test state action. From the Action Properties screen, choose **Substitute Data DWORD** and then select the **Substitute for** property. A drop-down menu is provided (see Figure 4.27 on page 314) that allows the choice of a custom DWORD or any of the four captured DWORD registers.


Action Properties
Type
Beep
Capture Data Dword
Inject
Link
Monitor/Count
Remove
Stop Scenario
Substitute
Data Dword
with SAS primitive
with SATA primitive
Trigger Output
Properties
Custom Dword
Captured Dword #0
Captured Dword #1
Captured Dword #2
Captured Dword #3
Substitute For
OK
Cancel

Type	Action
Description	
Random	No
Every Nth occurrence	1
Monitor/Count	Not monitored
Substitute For	Custom Dword
Pattern Field Name	
Pattern Field Value	
Pattern Field Mask	
Recalculate CRC	

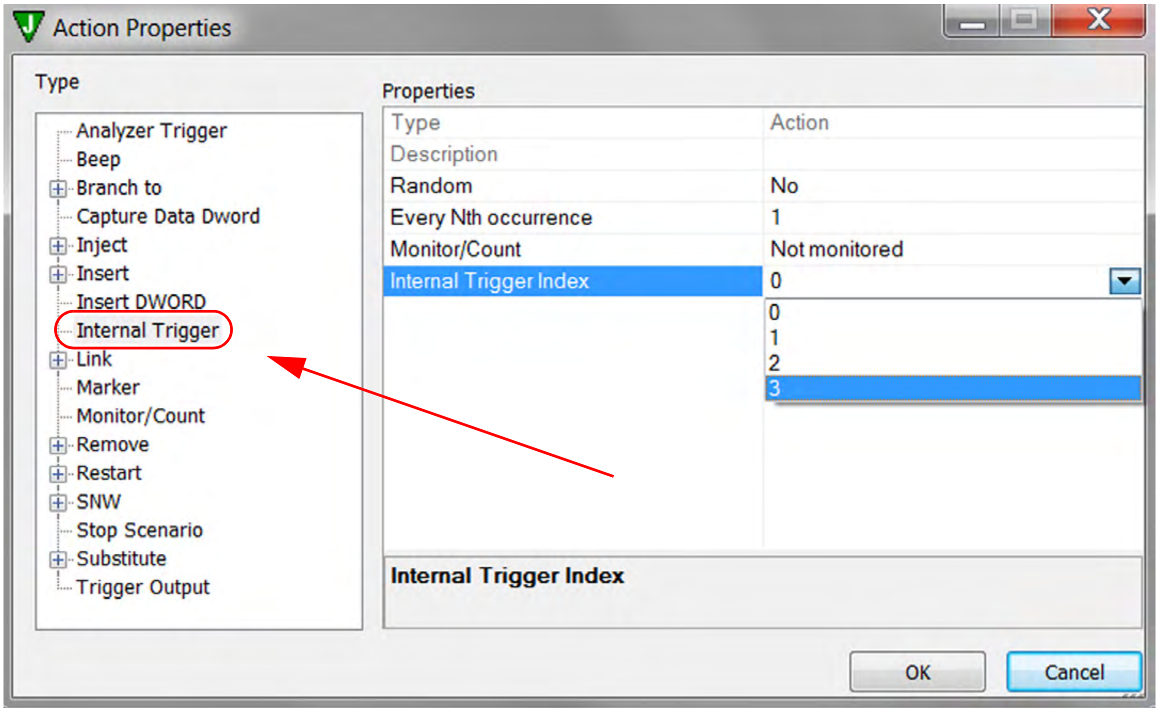
Figure 4.27: Using a Captured Data DWORD in Substitute DWORD Test Action

4.8.5 Generating an Internal Trigger

This feature has the following capabilities:

1. ‘Internal Trigger’ action to notify all other paths has been added, there are 4 internal trigger signals (0 to 3).
    a. Internal Trigger Action 0
    b. Internal Trigger Action 1
    c. Internal Trigger Action 2
    d. Internal Trigger Action 3
2. ‘Internal Trigger’ event to wait for others’ notifications has been added.
    a. Internal Trigger Event 0, which corresponds to Internal Trigger Action 0
    b. Internal Trigger Event 1, which corresponds to Internal Trigger Action 1
    c. Internal Trigger Event 2, which corresponds to Internal Trigger Action 2
    d. Internal Trigger Event 3, which corresponds to Internal Trigger Action 3

The above feature can cover a few requirements like, Stop All ports, bi-directional jamming and emulate wide port jammer. See Figure 4.28 on page 315.


Action Properties
Type
Analyzer Trigger
Beep
Branch to
Capture Data Dword
Inject
Insert
Insert DWORD
Internal Trigger
Link
Marker
Monitor/Count
Remove
Restart
SNW
Stop Scenario
Substitute
Trigger Output
Properties
0
1
2
3
OK
Cancel

Type	Action
Description	
Random	No
Every Nth occurrence	1
Monitor/Count	Not monitored
Internal Trigger Index	0

Internal Trigger Index

Figure 4.28: Internal Trigger Index

Example of Using Internal Triggers to Stop All Scenarios

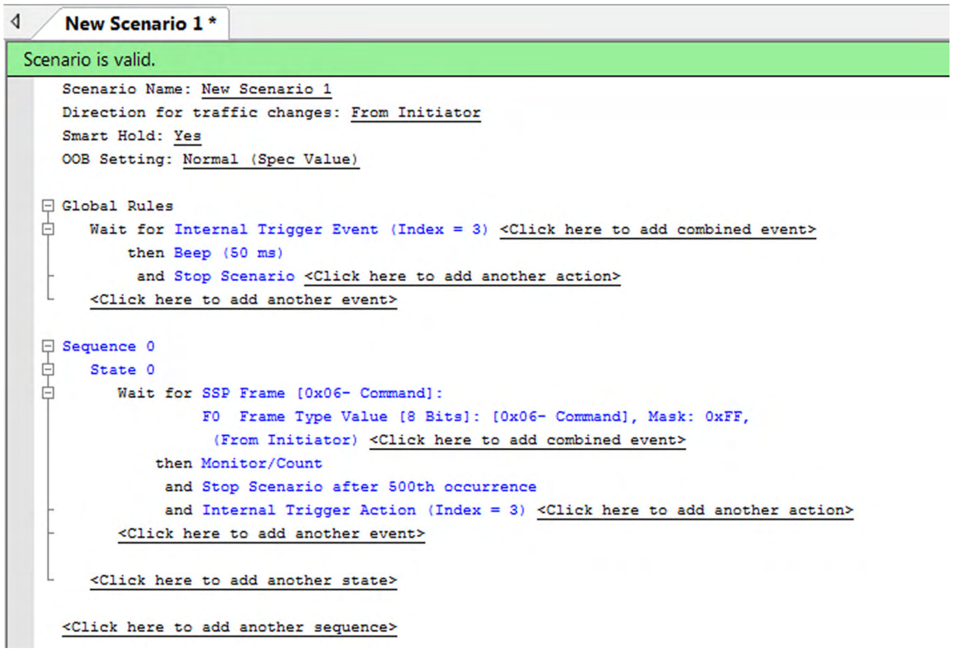
The example scenario can be generated to use any of the internal triggers to stop all scenarios. When this scenario (New Scenario 1) is run on all ports, as soon as any port finds the 500th occurrence of SSP Command Frame, the scenario will stop on that Port and send an internal trigger signal to all other ports. This internal trigger will then cause the scenarios running on any other port to stop.

The commands used in the script are shown below:

< Global Rules - waits for Internal Trigger Event then stop scenario >

< Sequence - waits for SSP Command Frame then Internal Trigger Action and stop scenario >

The commands to generate this scenario are shown below (see Figure 4.29 on page 316**).**


New Scenario 1 *

Scenario is valid.

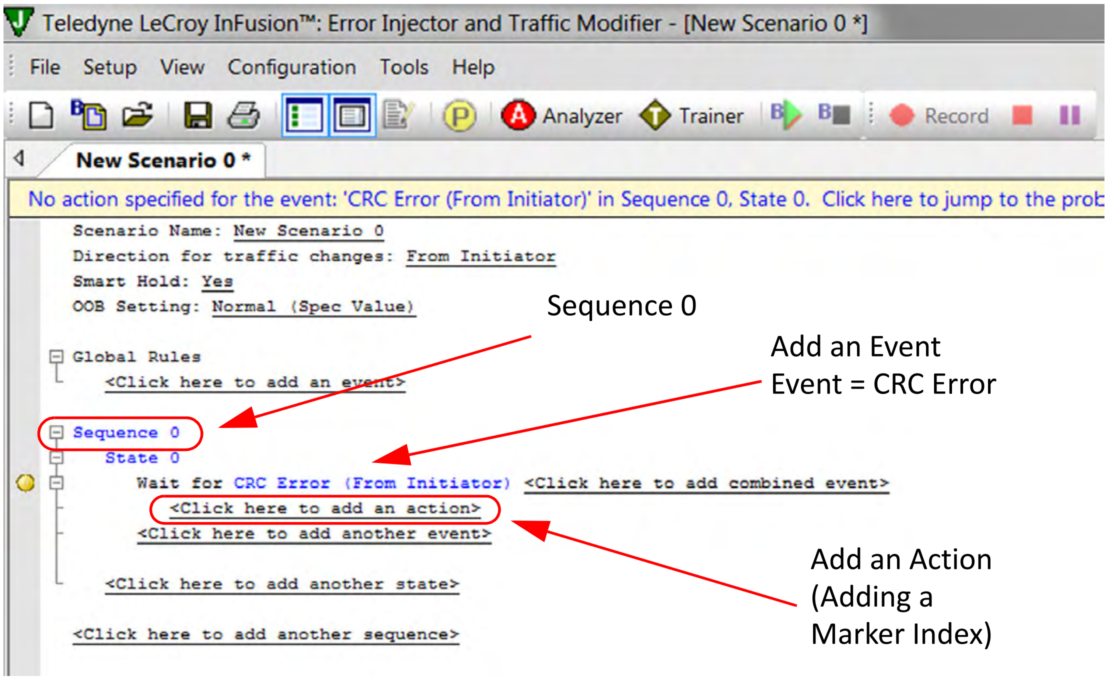
```
Scenario Name: New Scenario 1
Direction for traffic changes: From Initiator
Smart Hold: Yes
OOB Setting: Normal (Spec Value)

Global Rules
   Wait for Internal Trigger Event (Index = 3) <Click here to add combined event>
       then Beep (50 ms)
        and Stop Scenario <Click here to add another action>
   <Click here to add another event>

Sequence 0
   State 0
      Wait for SSP Frame [0x06- Command]:
               F0  Frame Type Value [8 Bits]: [0x06- Command], Mask: 0xFF,
                (From Initiator) <Click here to add combined event>
         then Monitor/Count
          and Stop Scenario after 500th occurrence
          and Internal Trigger Action (Index = 3) <Click here to add another action>
      <Click here to add another event>

   <Click here to add another state>

<Click here to add another sequence>
```

Figure 4.29: Scenario to Turn Off Scenarios with Internal Triggers

4.8.6 Generating a Jammer Marker

The main purpose of this feature to enable the user to mark specific parts of the captured traffic for easier tracking of data.

In Sequence 0 shown below, the Event is Waiting for a CRC Error. After that event occurs an Action will be taken, (see Figure 4.30 on page 316).


Teledyne LeCroy InFusion™: Error Injector and Traffic Modifier - [New Scenario 0 *]
File
Setup
View
Configuration
Tools
Help
Analyzer
Trainer
Record
New Scenario 0 *

No action specified for the event: 'CRC Error (From Initiator)' in Sequence 0, State 0. Click here to jump to the prob

```
Scenario Name: New Scenario 0
Direction for traffic changes: From Initiator
Smart Hold: Yes
OOB Setting: Normal (Spec Value)

Global Rules
   <Click here to add an event>

Sequence 0
   State 0
      Wait for CRC Error (From Initiator) <Click here to add combined event>
         <Click here to add an action>
      <Click here to add another event>

   <Click here to add another state>

<Click here to add another sequence>
```

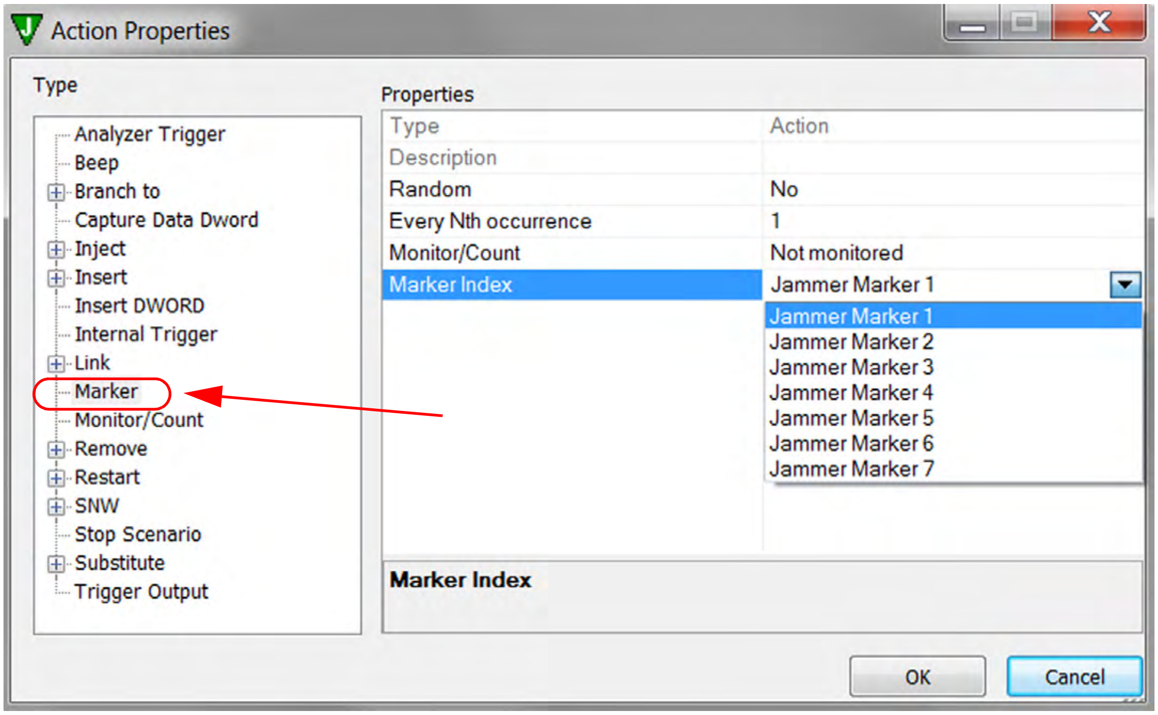
Sequence 0

Add an Event
Event = CRC Error

Add an Action
(Adding a
Marker Index)

Figure 4.30: Sequence 0: Event = CRC Error, then Add an Action

In this case, Click on <Click here to add an action> and the Action Properties Menu will pop up. To add a Jammer Marker, click on Marker and the Properties section of the Menu will show Marker Index. There are seven Jammer Markers available to the user. See Figure 4.31 on page 317.


Action Properties
Type
Analyzer Trigger
Beep
Branch to
Capture Data Dword
Inject
Insert
Insert DWORD
Internal Trigger
Link
Marker
Monitor/Count
Remove
Restart
SNW
Stop Scenario
Substitute
Trigger Output
Properties
Jammer Marker 1
Jammer Marker 2
Jammer Marker 3
Jammer Marker 4
Jammer Marker 5
Jammer Marker 6
Jammer Marker 7
Marker Index
OK
Cancel

Type	Action
Description	
Random	No
Every Nth occurrence	1
Monitor/Count	Not monitored
Marker Index	Jammer Marker 1

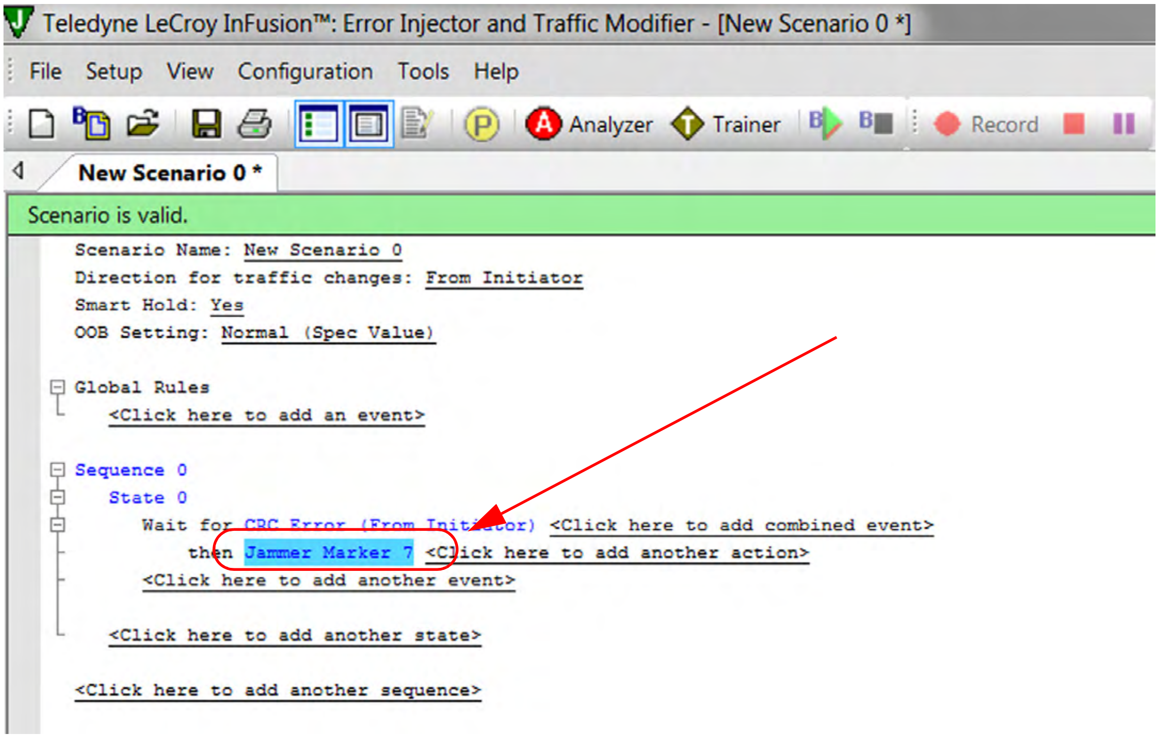
Figure 4.31: Jammer Marker Index 1 – 7

When the Jammer implements this action, the result is adding a marker to the captured trace in the analyzer data stream. See Figure 4.32 on page 318. The added marker (Bookmark = Jammer Marker 7) will be shown as a bookmark in the trace and you can see the list of markers in the bookmark dialog.

Note: As a function of recorded speed and port configuration, the InFusion marker might be off by a tolerance of up to 200 nsec.

Note: The limitation for adding markers to a trace is 10,000.

Note: Jammer Markers do not propagate across cascaded analyzers (see “Expandability” on page 22).


Teledyne LeCroy InFusion™: Error Injector and Traffic Modifier - [New Scenario 0 *]
File Setup View Configuration Tools Help
Analyzer
Trainer
Record
New Scenario 0 *

```
Scenario is valid.
Scenario Name: New Scenario 0
Direction for traffic changes: From Initiator
Smart Hold: Yes
OOB Setting: Normal (Spec Value)

Global Rules
   <Click here to add an event>

Sequence 0
   State 0
      Wait for CRC Error (From Initiator) <Click here to add combined event>
          then Jammer Marker 7 <Click here to add another action>
      <Click here to add another event>

   <Click here to add another state>

<Click here to add another sequence>
```

Figure 4.32: Sequence 0: Event = Wait for CRC Error, Action = Add Jammer Marker 7

4.8.7 Summary of Scenario Creation

The suggested process of creating and executing a scenario is as follows:

1. Create a scenario in the main library.
2. Save all scenarios in the main library to a InFusion device or a device of your choice.
3. Select the scenario in the main library that you want to run on the device.
4. To run the scenario, click the **Start Scenario** button from the Main Library toolbar. The device starts to monitor/modify traffic.

Note: Step 1 is described in detail for each example in following sections. Steps 2 to 5 are described in detail at the end of this chapter.

4.9 Creating Global Rules

This section gives examples for creating the Global Rules area of a scenario. Recall that the Global Rules area defines a single test state. The Global Rules do not have the capacity for multiple states, so that area of a scenario cannot change state.

In terms of InFusion testing, a state defines test “behavior.” In this context, behavior is “waiting” for an event and responding with an action or set of actions that happen simultaneously.

Keep in mind that a test state you implement with the Global Rules operates in parallel with the active test state of each sequence in the scenario.

In effect, InFusion lets you do up to three line tests at the same time. You can do one test with the Global Rules and a separate test with each sequence you create. You can have up to two sequences in a scenario.

The following table summarizes the Global Rules examples that follow.

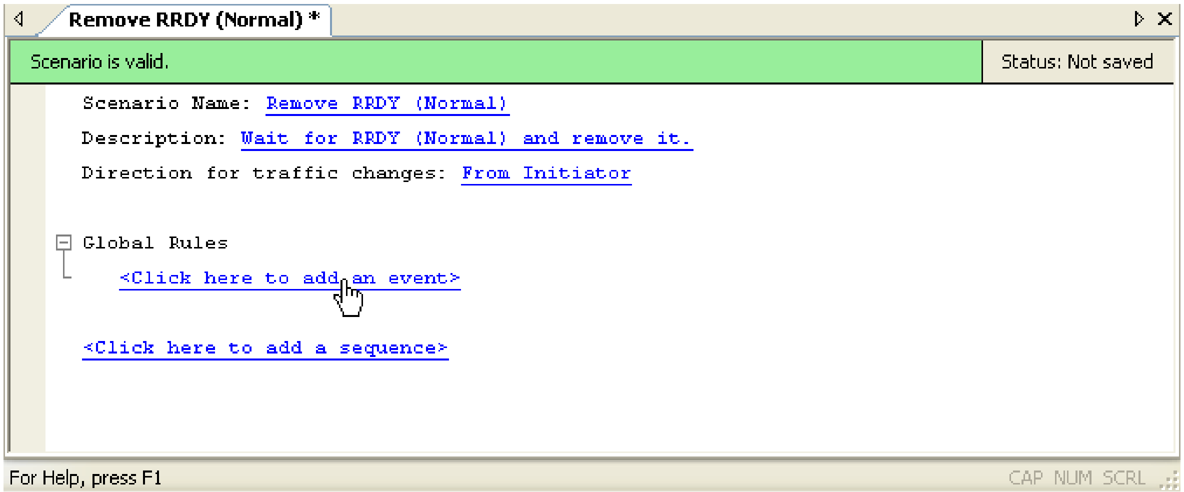
TABLE 4.4: Global Rules Examples

Example	Description
1	Creating a single event and action (removes a primitive).
2	Creating a single event and action (replaces a primitive).
3	Creating a combined event (a logical OR association of multiple events) and an action.
4	Creating multiple triggers and actions.
5	Creating multiple actions on a single event.
6	Using timers.

4.9.1 Example 1: Creating a Single Event and Action that Removes a Primitive

In this example, the Global Rules area of the scenario waits for each RRDY Normal primitive from the initiator and removes it.

1. Click the **New Scenario** button in the main library or one of the device libraries.
2. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change (see Figure 4.14 on page 297).
3. In the Global Rules area, click the prompt to **add an event**.



Scenario Name: Remove RRDY (Normal)
Description: Wait for RRDY (Normal) and remove it.
Direction for traffic changes: From Initiator

Global Rules
<Click here to add an event>

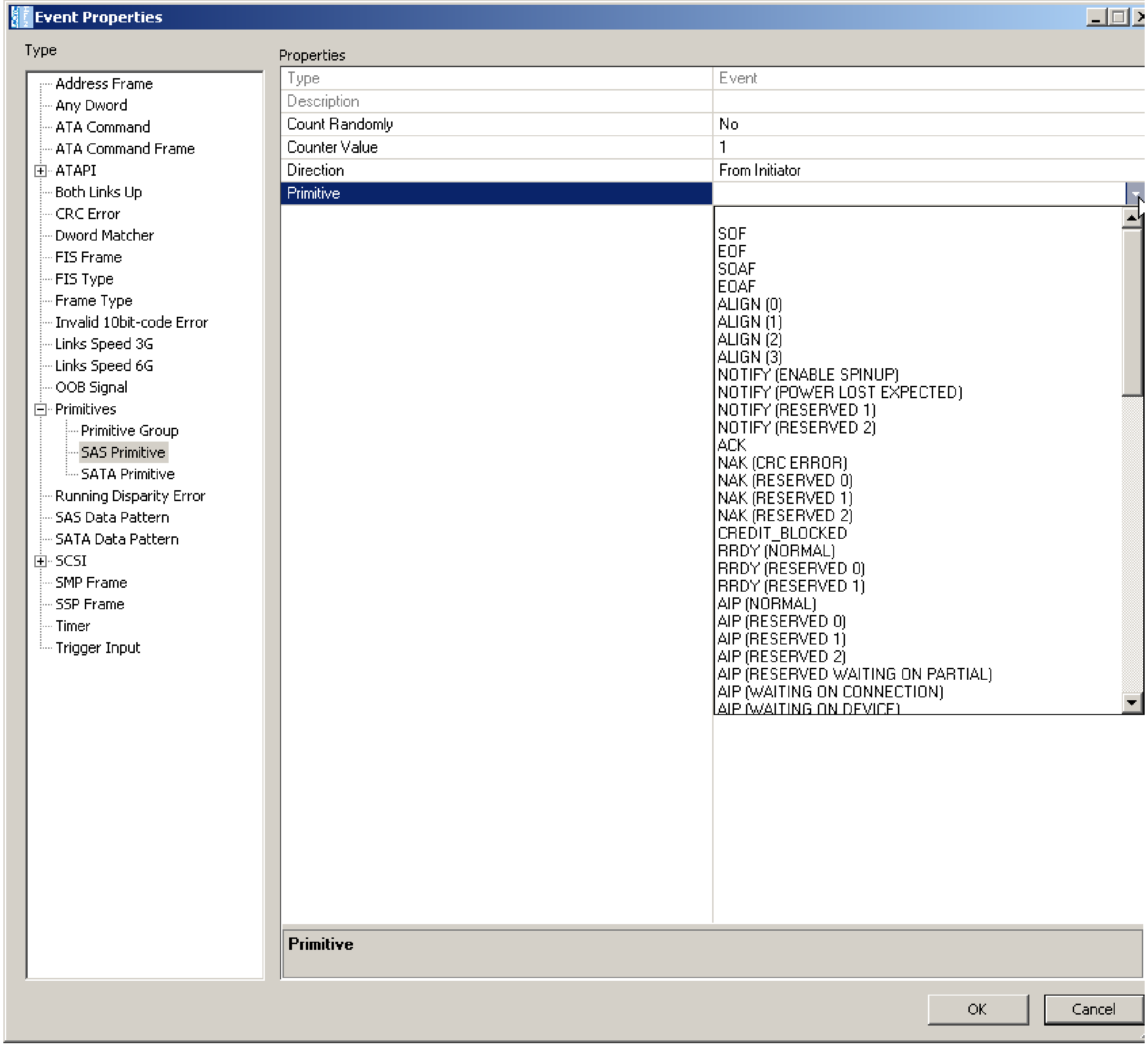
<Click here to add a sequence>

Figure 4.33: Example 1: Adding an Event

The Event Properties dialog box displays (see Figure 4.22 on page 303).

4. In the Type column of the Event Properties dialog, choose **Primitive > SAS Primitive**.

5. In the Type column in the middle of the dialog box, click **Description** if you want to add a description of the event.
6. Click **Direction** to choose the direction of traffic to monitor for the selected event (the default is **From Initiator**, which is what you want for this example).
7. Still in the middle column of the Event Properties dialog box, click **Primitive** to display a drop-down menu that lets you choose the type of primitive for which you want to wait in this scenario. In this example, it is **RRDY (Normal)**.

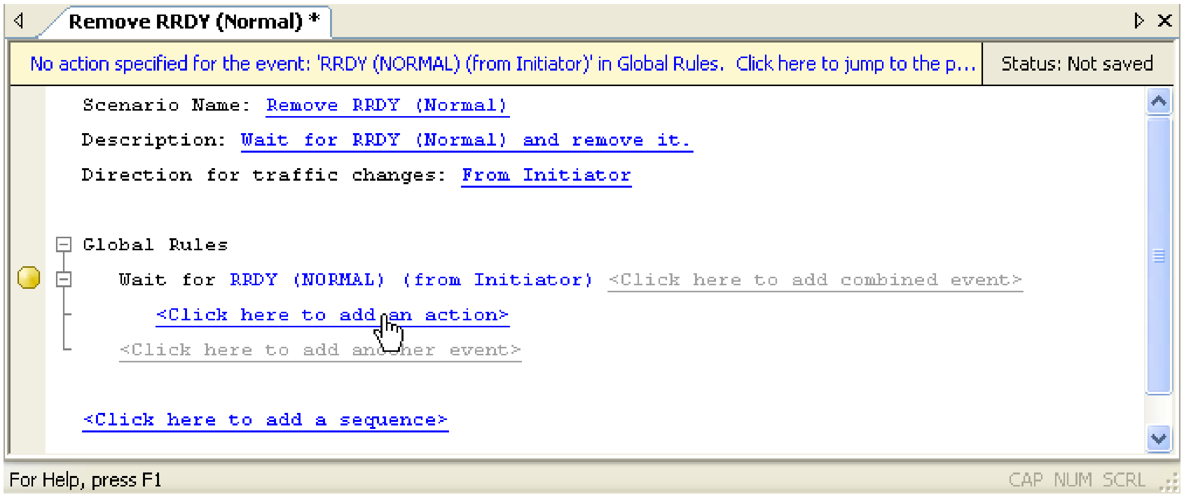

Event Properties
Type
Address Frame
Any Dword
ATA Command
ATA Command Frame
ATAPI
Both Links Up
CRC Error
Dword Matcher
FIS Frame
FIS Type
Frame Type
Invalid 10bit-code Error
Links Speed 3G
Links Speed 6G
OOB Signal
Primitives
Primitive Group
SAS Primitive
SATA Primitive
Running Disparity Error
SAS Data Pattern
SATA Data Pattern
SCSI
SMP Frame
SSP Frame
Timer
Trigger Input
Properties
SOF
EOF
SOAF
EOAF
ALIGN (0)
ALIGN (1)
ALIGN (2)
ALIGN (3)
NOTIFY (ENABLE SPINUP)
NOTIFY (POWER LOST EXPECTED)
NOTIFY (RESERVED 1)
NOTIFY (RESERVED 2)
ACK
NAK (CRC ERROR)
NAK (RESERVED 0)
NAK (RESERVED 1)
NAK (RESERVED 2)
CREDIT_BLOCKED
RRDY (NORMAL)
RRDY (RESERVED 0)
RRDY (RESERVED 1)
AIP (NORMAL)
AIP (RESERVED 0)
AIP (RESERVED 1)
AIP (RESERVED 2)
AIP (RESERVED WAITING ON PARTIAL)
AIP (WAITING ON CONNECTION)
AIP (WAITING ON DEVICE)
Primitive
OK
Cancel

Type	Event
Description	
Count Randomly	No
Counter Value	1
Direction	From Initiator
Primitive	

Figure 4.34: Example 1: Event Drop-Down List

8. Click **OK** to close the Event Properties dialog box.

9. In the Global Rules area, click the prompt to **add an action**.



No action specified for the event: 'RRDY (NORMAL) (from Initiator)' in Global Rules. Click here to jump to the p...

Status: Not saved

Scenario Name: Remove RRDY (Normal)
Description: Wait for RRDY (Normal) and remove it.
Direction for traffic changes: From Initiator

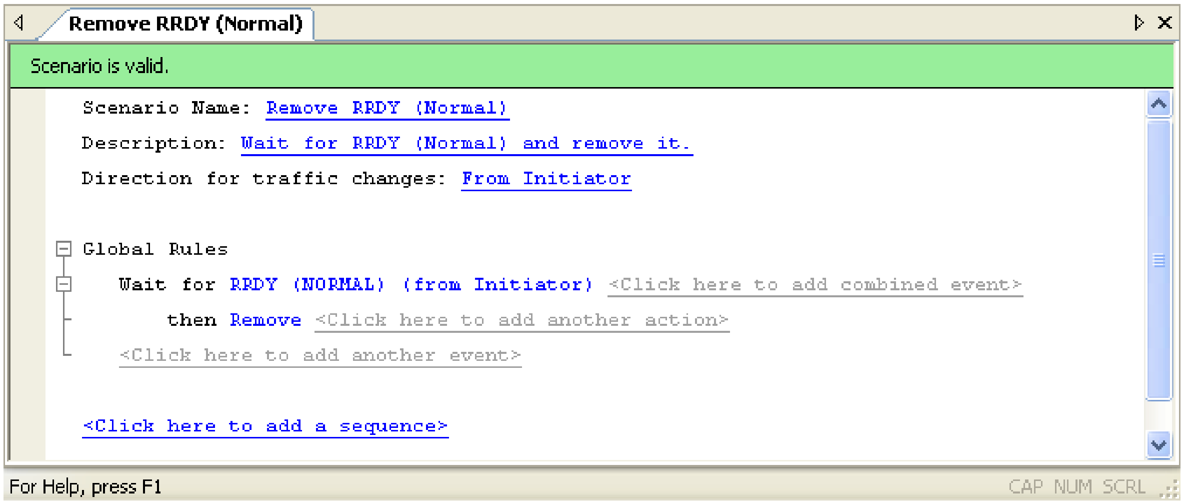
Global Rules
Wait for RRDY (NORMAL) (from Initiator) <Click here to add combined event>
<Click here to add an action>
<Click here to add another event>

<Click here to add a sequence>

Figure 4.35: Example 1: Entering an Action

The Action Properties dialog box appears (see Figure 4.24 on page 308).

10. In the Type column on the left, choose the action that you want to occur when an RRDY is detected. In this example, it is the **Remove Primitive** action. Select Random **Yes** or **No**, **N** for Every Nth occurrence, and Monitor/Count as **Monitored** or **Not Monitored.**
11. Click **OK** to close the Action Properties dialog box.



Scenario is valid.

Scenario Name: Remove RRDY (Normal)
Description: Wait for RRDY (Normal) and remove it.
Direction for traffic changes: From Initiator

Global Rules
Wait for RRDY (NORMAL) (from Initiator) <Click here to add combined event>
then Remove <Click here to add another action>
<Click here to add another event>

<Click here to add a sequence>

Figure 4.36: Example1: Complete Scenario

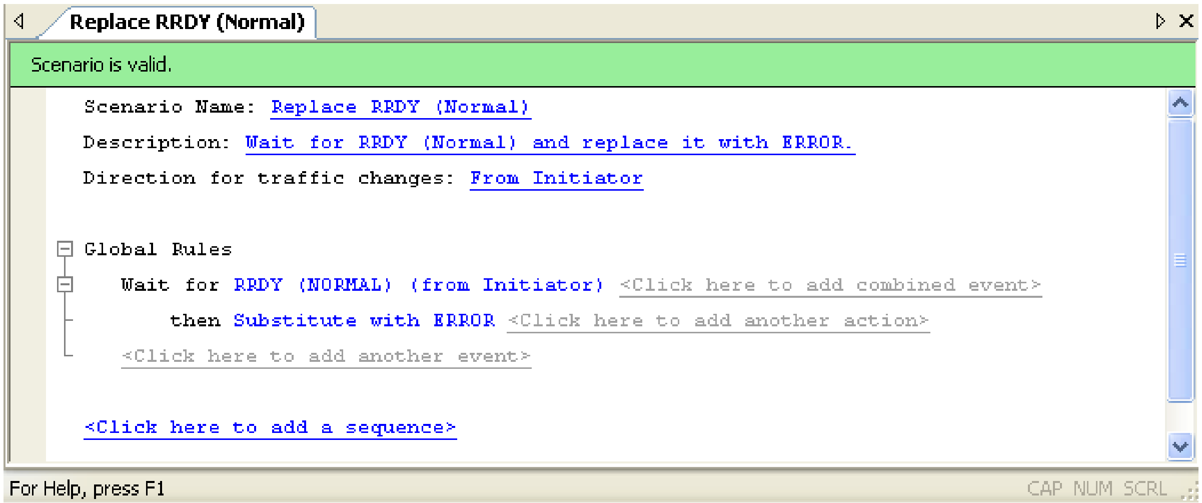
12. In the File menu, select **Save Scenario** to save the scenario.

4.9.2 Example 2: Wait for a Primitive and Replace It with an Error

In this example, the Global Rules portion of the scenario waits for each RRDY Normal primitive and replaces it with an ERROR primitive.

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. In the Global Rules area, click the prompt to **add an event** to display the Event Properties dialog box.
3. As you did in the previous example, choose **RRDY (Normal)** as the type of primitive to monitor.
4. In the Global Rules area, click the prompt to **add an action** to display the Action Properties dialog box.
5. In the Type column on the left, choose **Substitute > with SAS Primitive** as the action that you want when an RRDY (Normal) occurs.
6. In the middle column of the dialog box, click **Description** if you want to add a description of the action.
7. Still in the middle column of the Event Properties dialog box, click **Primitive** to display a drop-down menu that lets you choose the type of primitive for which to substitute for RRDY (Normal) (see Figure 4.34 on page 320). Choose **ERROR**.
8. Click **OK** to close the Action Properties dialog box.
9. In the File menu, select **Save Scenario** to save the scenario.

In this example, you set the substitution action to happen at every occurrence of an RRDY (Normal) (as shown in the figure, the action is set for every occurrence). However, you can set an action to happen at other multiples of event occurrence (for example 5, 25, 1000 and so on). You also can set the action to happen at random, within a specified number of event occurrences.



Scenario is valid.

```
Scenario Name: Replace RRDY (Normal)
Description: Wait for RRDY (Normal) and replace it with ERROR.
Direction for traffic changes: From Initiator

Global Rules
   Wait for RRDY (NORMAL) (from Initiator) <Click here to add combined event>
       then Substitute with ERROR <Click here to add another action>
   <Click here to add another event>

<Click here to add a sequence>
```

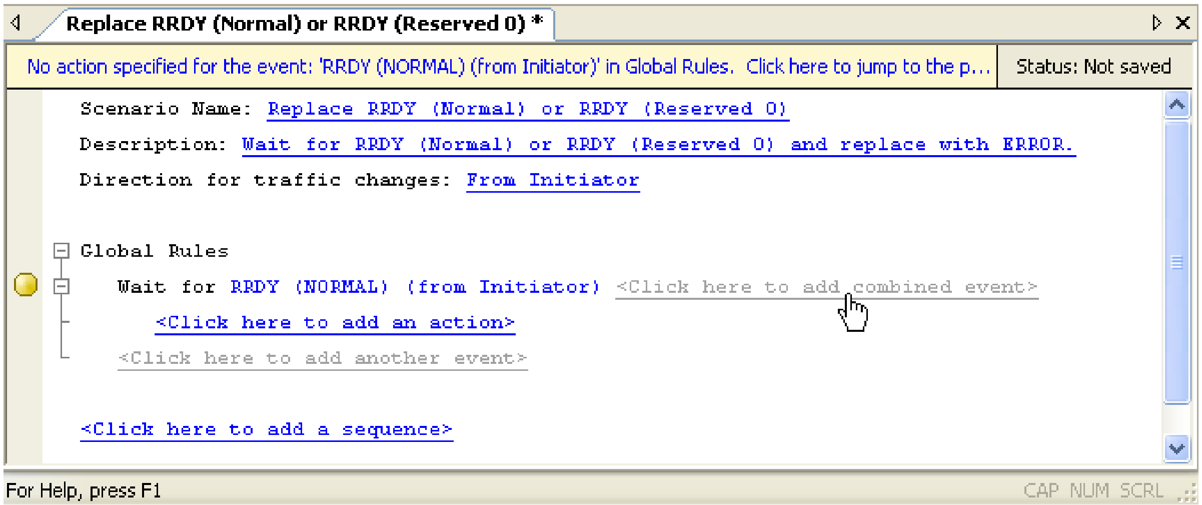
Figure 4.37: Example 2: Complete Scenario

4.9.3 Example 3: Creating OR Conditions

In this example, the Global Rules area of the scenario waits for either of two types of RRDY primitive and replaces them with an ERROR primitive.

This example includes a combined event (a logical OR association of two or more single events). Here, the combined event consists of any occurrence of RRDY (Normal) or RRDY (Reserved 0).

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. In the Global Rules area, click the prompt to **add an event** to display the Event Properties dialog box.
3. As you did in example 1 of this chapter, choose **RRDY (Normal)** as the first primitive that you want to monitor.
4. Click the **add combined event** prompt to add a second event.



No action specified for the event: 'RRDY (NORMAL) (from Initiator)' in Global Rules. Click here to jump to the p...

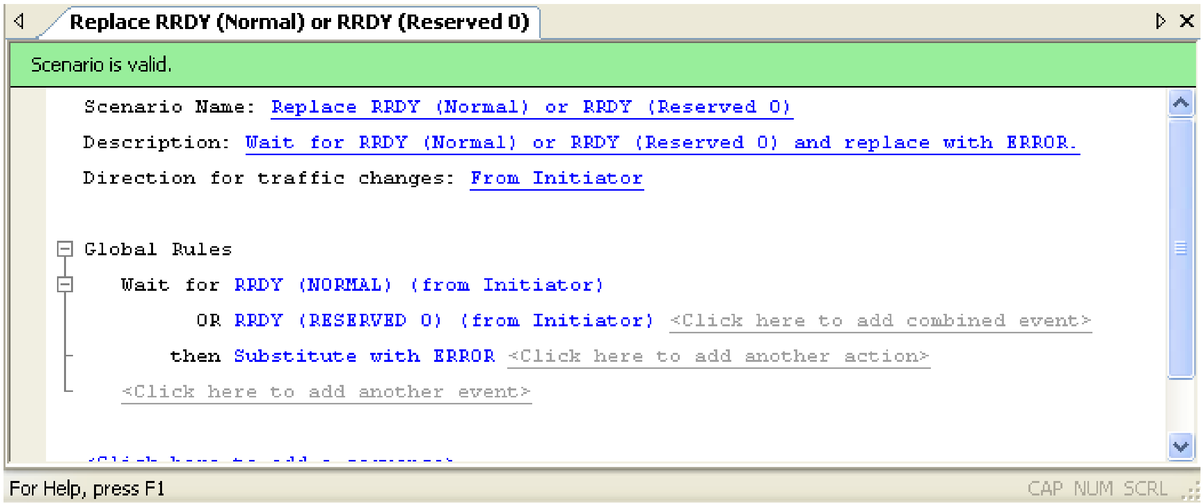
```
Scenario Name: Replace RRDY (Normal) or RRDY (Reserved 0)
Description: Wait for RRDY (Normal) or RRDY (Reserved 0) and replace with ERROR.
Direction for traffic changes: From Initiator

Global Rules
   Wait for RRDY (NORMAL) (from Initiator) <Click here to add combined event>
      <Click here to add an action>
   <Click here to add another event>

<Click here to add a sequence>
```

Figure 4.38: Example 3: Entering the Second Event

The Event Properties dialog box appears.

5. Choose **RRDY (Reserved 0)** as the second primitive that you want to monitor.
6. Click **OK** to close the Event Properties dialog box.
7. In the Global Rules area, click the prompt to **add an action** to display the Action Properties dialog box.
8. In the Type list on the left, choose **Substitute SAS Primitive** as the action that you want when either RRDY Reserved 0 or RRDY Normal occurs.
9. Click **OK** to close the Action Properties dialog box.

10. In the File menu, select **Save Scenario** to save the scenario.



Scenario is valid.

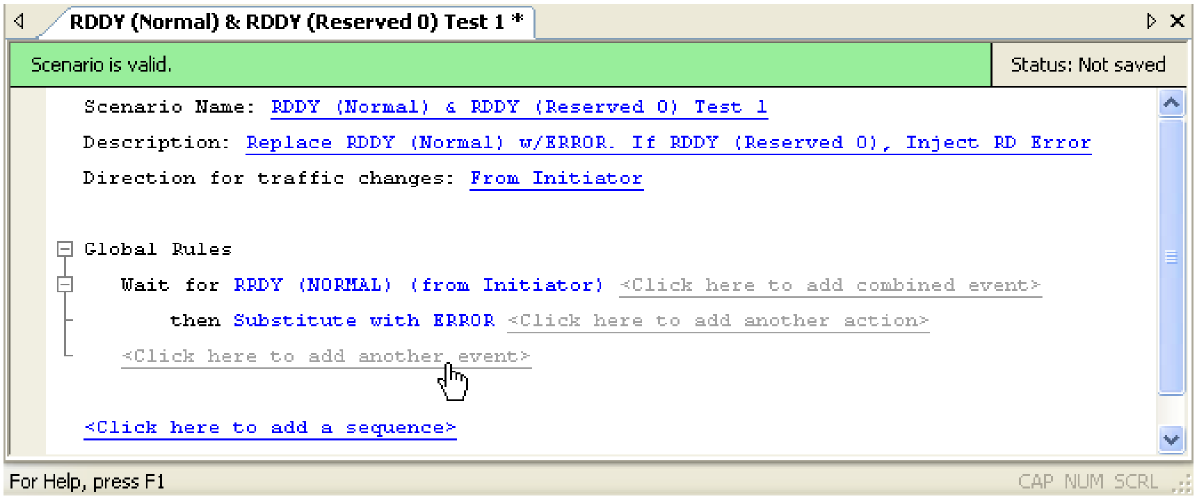
```
Scenario Name: Replace RRDY (Normal) or RRDY (Reserved 0)
Description: Wait for RRDY (Normal) or RRDY (Reserved 0) and replace with ERROR.
Direction for traffic changes: From Initiator

Global Rules
   Wait for RRDY (NORMAL) (from Initiator)
         OR RRDY (RESERVED 0) (from Initiator) <Click here to add combined event>
       then Substitute with ERROR <Click here to add another action>
   <Click here to add another event>
```

Figure 4.39: Example 3: Complete Scenario

4.9.4 Example 4: Multiple Triggers and Actions

In this example, the Global Rules area of the scenario waits for two events, each of which triggers a different action.

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. As you did in example 2, choose **RRDY (Normal)** as the first event to monitor, and substitute with the SAS primitive **ERROR** as action.
3. In the Global Rules area, click the prompt to **add the next event** (keep in mind this is not a combined event).



Scenario is valid.

Status: Not saved

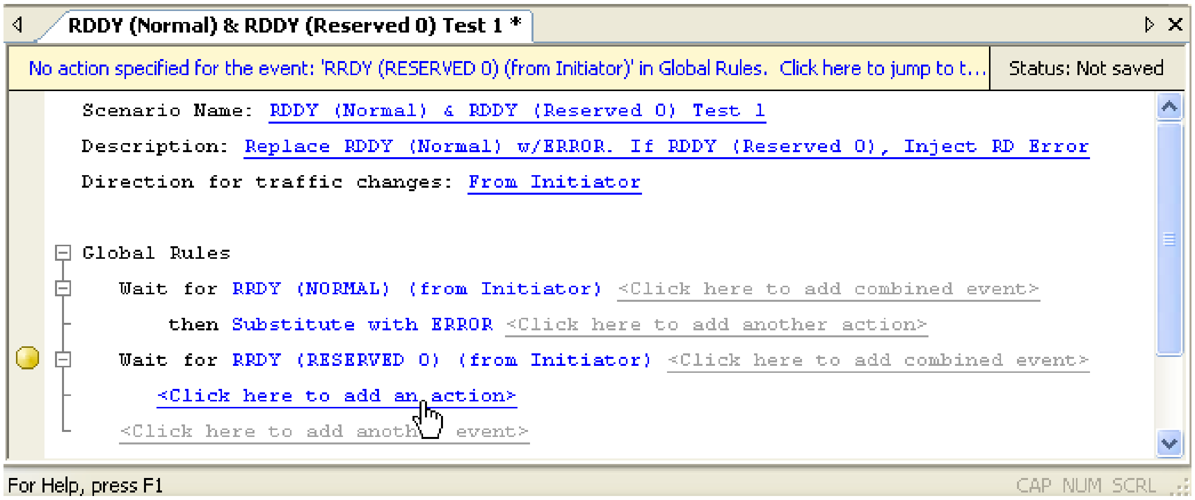
```
Scenario Name: RDDY (Normal) & RDDY (Reserved 0) Test 1
Description: Replace RDDY (Normal) w/ERROR. If RDDY (Reserved 0), Inject RD Error
Direction for traffic changes: From Initiator

Global Rules
   Wait for RRDY (NORMAL) (from Initiator) <Click here to add combined event>
       then Substitute with ERROR <Click here to add another action>
   <Click here to add another event>

<Click here to add a sequence>
```

Figure 4.40: Example 4: Entering Second Event

The Event Properties dialog box appears.

In this example, there is a parallel set of events, but each event is associated with its own action. In a combined event, there is a parallel set of events sharing the same action.

4. Using the drop-down menu, choose **RRDY (Reserved 0)** as the second event to monitor.
5. Click **OK** to close the Event Properties dialog box.
6. In the Global Rules area, click the prompt to **add an action** to be triggered by the RRDY (Reserved 0).



RDDY (Normal) & RDDY (Reserved 0) Test 1 *

No action specified for the event: 'RRDY (RESERVED 0) (from Initiator)' in Global Rules. Click here to jump to t… Status: Not saved

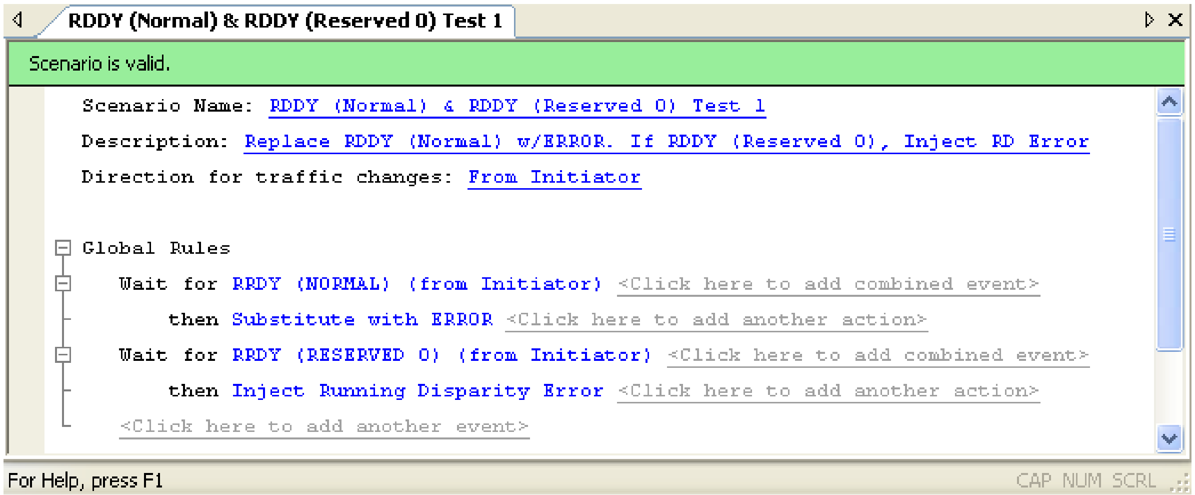
```
Scenario Name: RDDY (Normal) & RDDY (Reserved 0) Test 1
Description: Replace RDDY (Normal) w/ERROR. If RDDY (Reserved 0), Inject RD Error
Direction for traffic changes: From Initiator

Global Rules
   Wait for RRDY (NORMAL) (from Initiator) <Click here to add combined event>
      then Substitute with ERROR <Click here to add another action>
   Wait for RRDY (RESERVED 0) (from Initiator) <Click here to add combined event>
      <Click here to add an action>
   <Click here to add another event>
```

For Help, press F1 CAP NUM SCRL

Figure 4.41: Example 4: Entering Second Action

The Action Properties dialog box appears.

7. Use it to choose **Inject RD Error** as the action triggered by RRDY (Reserved 0).
8. Click **OK** to close the Action Properties dialog box.



RDDY (Normal) & RDDY (Reserved 0) Test 1

Scenario is valid.

```
Scenario Name: RDDY (Normal) & RDDY (Reserved 0) Test 1
Description: Replace RDDY (Normal) w/ERROR. If RDDY (Reserved 0), Inject RD Error
Direction for traffic changes: From Initiator

Global Rules
   Wait for RRDY (NORMAL) (from Initiator) <Click here to add combined event>
      then Substitute with ERROR <Click here to add another action>
   Wait for RRDY (RESERVED 0) (from Initiator) <Click here to add combined event>
      then Inject Running Disparity Error <Click here to add another action>
   <Click here to add another event>
```

For Help, press F1 CAP NUM SCRL

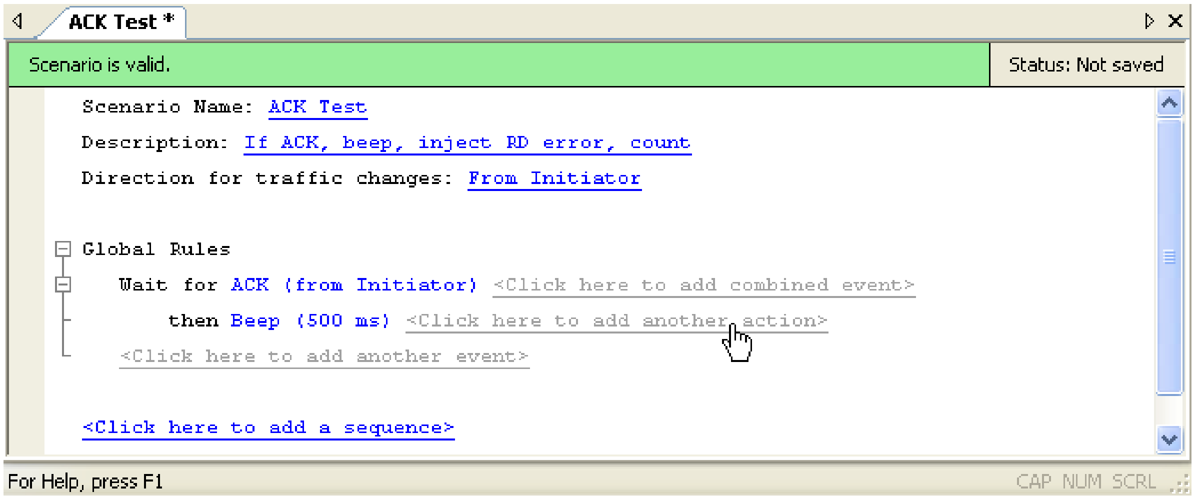
Figure 4.42: Example 4: Complete Scenario

9. In the File menu, select **Save Scenario** to save the scenario.

4.9.5 Example 5: Multiple Actions on a Single Event

In this example, an event triggers a set of actions. The actions occur at the same time. The device waits for an ACK from the initiator. When it occurs, the device beeps, injects an RD error, and increments a counter monitoring for that event (ACK from initiator).

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. As in previous examples, configure the first event and its response in the Global Rules area. Choose **ACK** primitive as the event and **Beep** as the action. From the Action Properties drop-down menu, enter **500 ms** as the duration of the beep.
3. Click the **add another action** prompt to add a second action.



Scenario is valid.

Status: Not saved

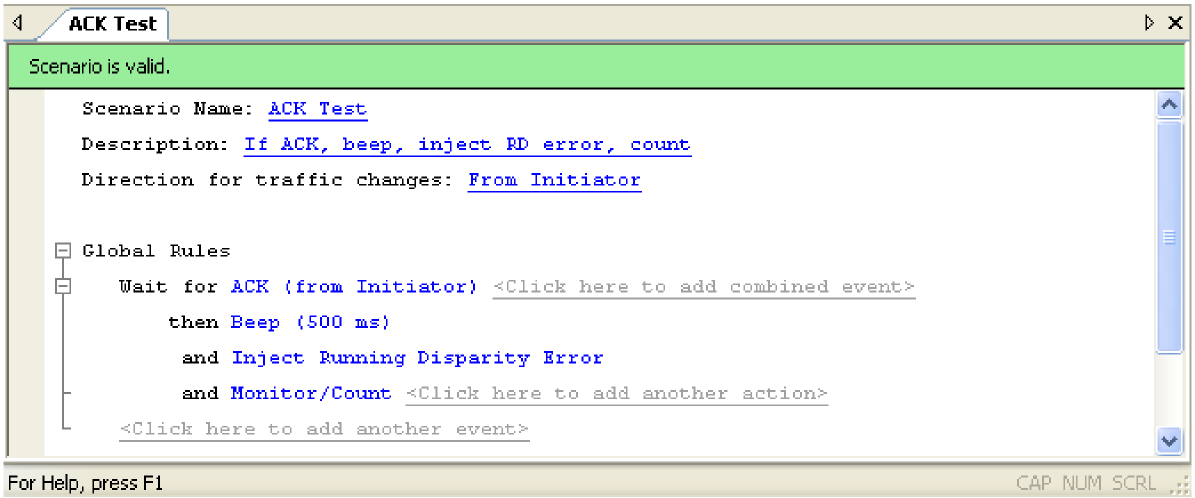
```
Scenario Name: ACK Test
Description: If ACK, beep, inject RD error, count
Direction for traffic changes: From Initiator

Global Rules
   Wait for ACK (from Initiator) <Click here to add combined event>
       then Beep (500 ms) <Click here to add another action>
   <Click here to add another event>

<Click here to add a sequence>
```

Figure 4.43: Example 5: Entering the Second Action

The Action Properties dialog box displays.

4. Choose **Inject RD Error** as the second action.
5. Click the **add another action** prompt to add a third action.
6. The Action Properties dialog box appears.
7. Choose **Monitor/Count** as the third action.

8. Click **OK** to close the Action Properties dialog box.



Scenario is valid.

```
Scenario Name: ACK Test
Description: If ACK, beep, inject RD error, count
Direction for traffic changes: From Initiator

Global Rules
   Wait for ACK (from Initiator) <Click here to add combined event>
       then Beep (500 ms)
        and Inject Running Disparity Error
        and Monitor/Count <Click here to add another action>
   <Click here to add another event>
```

Figure 4.44: Example 5: Complete Scenario

9. In the File menu, select **Save Scenario** to save the scenario.

This example sets the counter to increment at each occurrence of an ACK (every 1 ACK).

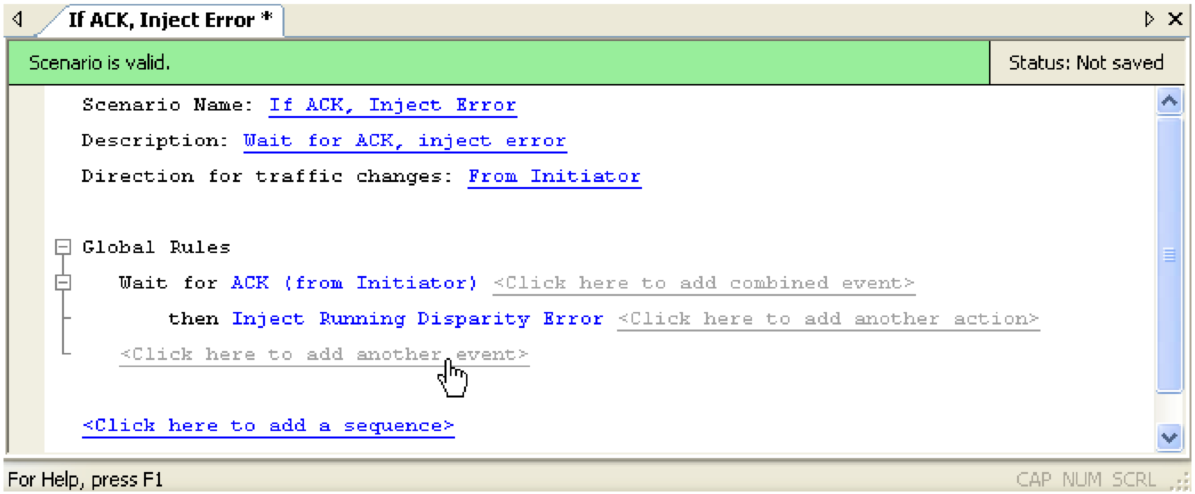
4.9.6 Example 6: Using Timers

In this example, the Global Rules portion of the scenario waits for an ACK primitive from the initiator. Each time the device detects an ACK, it injects an RD Error into the traffic stream. This state continues for a random period of time, not to exceed 1.790 seconds. After the time period has elapsed (timer times out), the scenario stops.

Although this example sets the timer for a random period, you also can set the timer for known values (2 ms., 5 mins., 1 hr., and so on).

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. As in previous examples, configure the first event and its response in the Global Rules area. Choose **ACK** primitive as the event and **Inject RD Error** as the action.

3. Click the prompt to **add another event** (keep in mind this is not a combined event).


If ACK, Inject Error *
Scenario is valid.
Status: Not saved

Scenario Name: If ACK, Inject Error
Description: Wait for ACK, inject error
Direction for traffic changes: From Initiator

Global Rules
Wait for ACK (from Initiator) <Click here to add combined event>
then Inject Running Disparity Error <Click here to add another action>
<Click here to add another event>

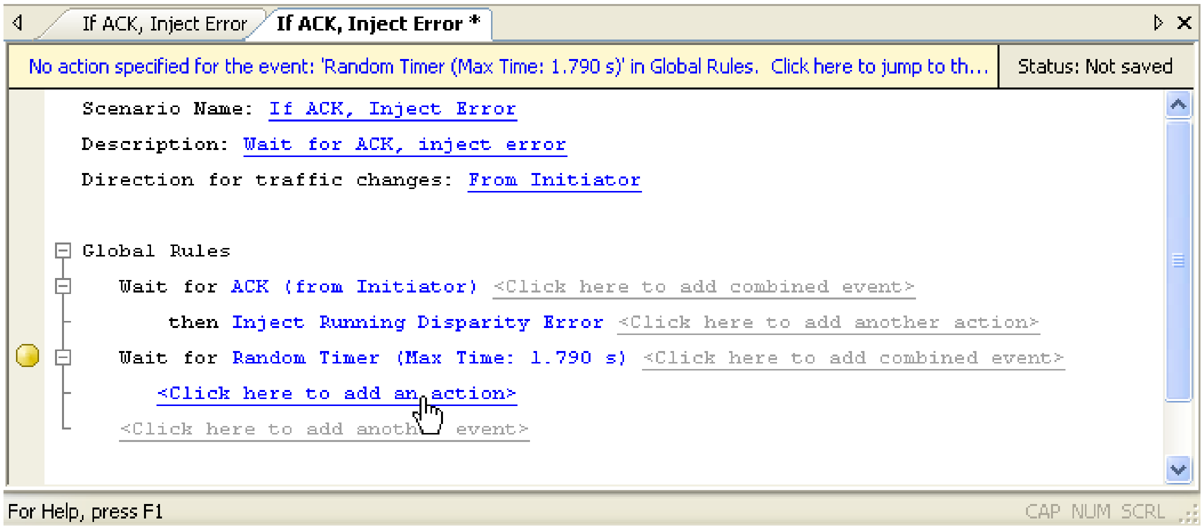
<Click here to add a sequence>

For Help, press F1
CAP NUM SCRL

Figure 4.45: Example 6: Entering the Second Event

The Event Properties dialog box displays.

4. In the Type column on the left, choose **Timer**. Set the timer for random timing with a maximum time limit of 1.790 seconds.
5. Click **OK** to close the Event Properties dialog box.
6. Click the prompt to **add an action** to correspond with the second event.


If ACK, Inject Error
If ACK, Inject Error *
No action specified for the event: 'Random Timer (Max Time: 1.790 s)' in Global Rules. Click here to jump to th...
Status: Not saved

Scenario Name: If ACK, Inject Error
Description: Wait for ACK, inject error
Direction for traffic changes: From Initiator

Global Rules
Wait for ACK (from Initiator) <Click here to add combined event>
then Inject Running Disparity Error <Click here to add another action>
Wait for Random Timer (Max Time: 1.790 s) <Click here to add combined event>
<Click here to add an action>
<Click here to add another event>

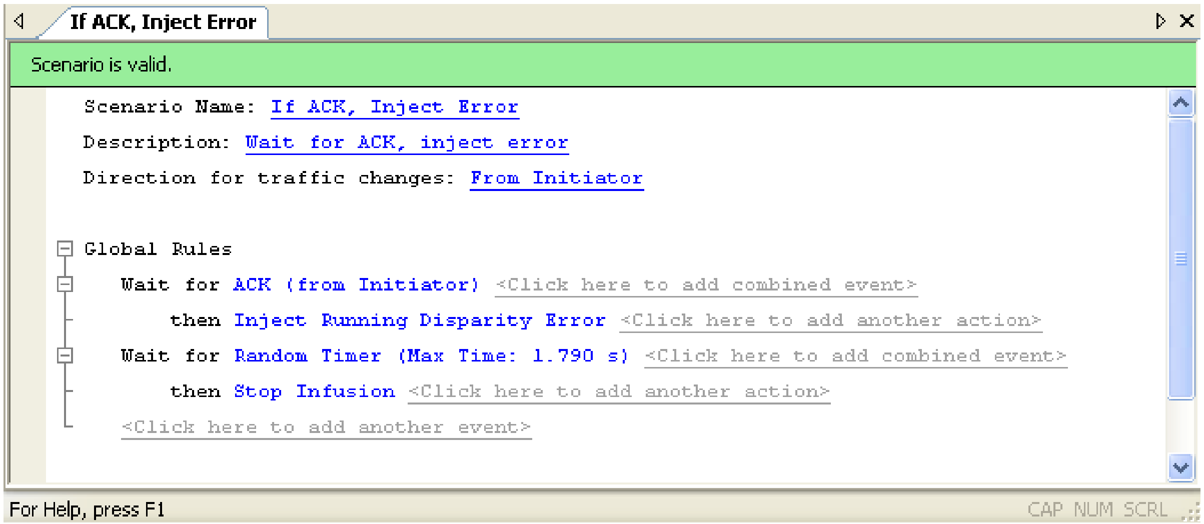
For Help, press F1
CAP NUM SCRL

Figure 4.46: Example 6: Entering Second Action

The Action Properties dialog box appears.

7. In the Type list on the left, choose **Stop Scenario** as the action that you want after the timer has expired.

8. Click **OK** to close the Action Properties dialog box.



Scenario is valid.

```
Scenario Name: If ACK, Inject Error
Description: Wait for ACK, inject error
Direction for traffic changes: From Initiator

Global Rules
   Wait for ACK (from Initiator) <Click here to add combined event>
      then Inject Running Disparity Error <Click here to add another action>
   Wait for Random Timer (Max Time: 1.790 s) <Click here to add combined event>
      then Stop Infusion <Click here to add another action>
   <Click here to add another event>
```

Figure 4.47: Example 6: Complete Scenario

9. In the File menu, select **Save Scenario** to save the scenario.

4.10 Creating a Sequence

This section gives several examples for creating sequences. Recall that a sequence can have multiple states, but only one state is active at any time. In other words, at any point in time, a sequence "waits" for one event (or combined event) and responds with the corresponding action or set of actions when the event occurs.

A sequence is more powerful than Global Rules, because you can create branching or looping test logic with a sequence.You can include up to two sequences in a scenario, but each is completely independent of the other. There is no branching or other interaction between the two, except through the Restart All Sequences action.

You must follow some simple rules when creating sequences:

TABLE 4.5: Sequence Rules

You can use only two branch actions per state. When you specify actions for a state, you can only use two instances of **Branch to an Existing State** or **Branch to a New State**. If you try to use more than two, a red error message appears in the status area of the application that says "Too Many Actions."
You can use only one restart sequence action per state. When you specify actions for a state, you can only use one instance of **Restart Current Sequence** or **Restart All Sequences**. If you try to use more than one, a red error message appears in the status area of the application that says "Too Many Actions."
You can use a maximum of 255 states per sequence. If you try to use more than 255 states, a red error message appears in the status area of the application.

The following table summarizes the examples that follow.

TABLE 4.6: Sequence Examples

Example	Description
7	**Creating two sequences and Global Rules**: This scenario has two objectives that you implement with Global Rules and two sequences. 1) You use Global Rules to replace any of three types of primitives. 2) You use two sequences to detect the order in which a type of frame is received from initiator and target.
8	**Creating a sequence with many states #1**: The objective of this scenario is to detect an incorrect order of primitives and to cause the device to beep when it happens. You implement this scenario with a single five-state sequence.
9	**Creating a sequence with many states #2**: This scenario is an enhancement of example 8. In this scenario, the objective is to detect an incorrect order of primitives, fix it, and cause the device to beep when this happens. As with example 8, you implement this scenario with a single five-state sequence.

4.10.1 Example 7: Creating Two Sequences and Global Rules

In this example, Global Rules substitute an Align (0) primitive for each of the following received from the initiator: Align (1), Align (2), and Align (3). As a separate test operation, two sequences determine the order in which each Identify Address frame is received from initiator and target.

The following tables summarize the logic implemented by each of the sequences.

TABLE 4.7: Example 7: Logic of Sequence 0

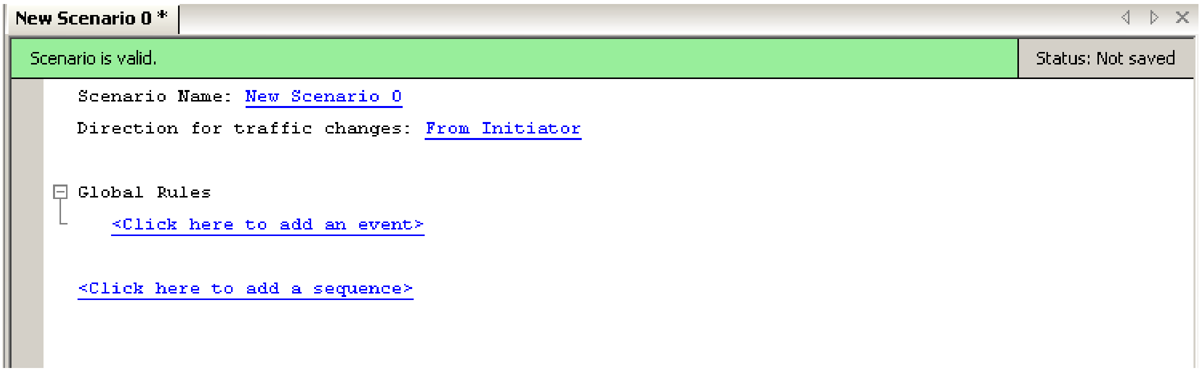
State	Description
State 0	If Address Frame is detected from initiator, go to State 1; otherwise, continue to check incoming frames (do not change state).
State 1	If next Address Frame detected is from target, beep 1 second.

TABLE 4.8: Example 7: Logic of Sequence 1

State	Description
State 0	If Address Frame is detected from target, go to State 1; otherwise, continue to check incoming frames (do not change state).
State 1	If next Address Frame detected is from initiator, beep 2 seconds.

There is no interaction between the two sequences. Each of them operates independently (and is independent of the Global Rules). However, the two sequences complement each other with their logic. In this sense, they both combine to implement a test objective.

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. As in previous examples, create the Global Rules area.
3. Click the prompt to **add a sequence**. Prompts for the sequence appear beneath the Global Rules area. You create a sequence one state at a time. The application numbers states consecutively from 0 up (1, 2, 3, and so on).



Scenario is valid.

Status: Not saved

Scenario Name: New Scenario 0

Direction for traffic changes: From Initiator

Global Rules

<Click here to add an event>

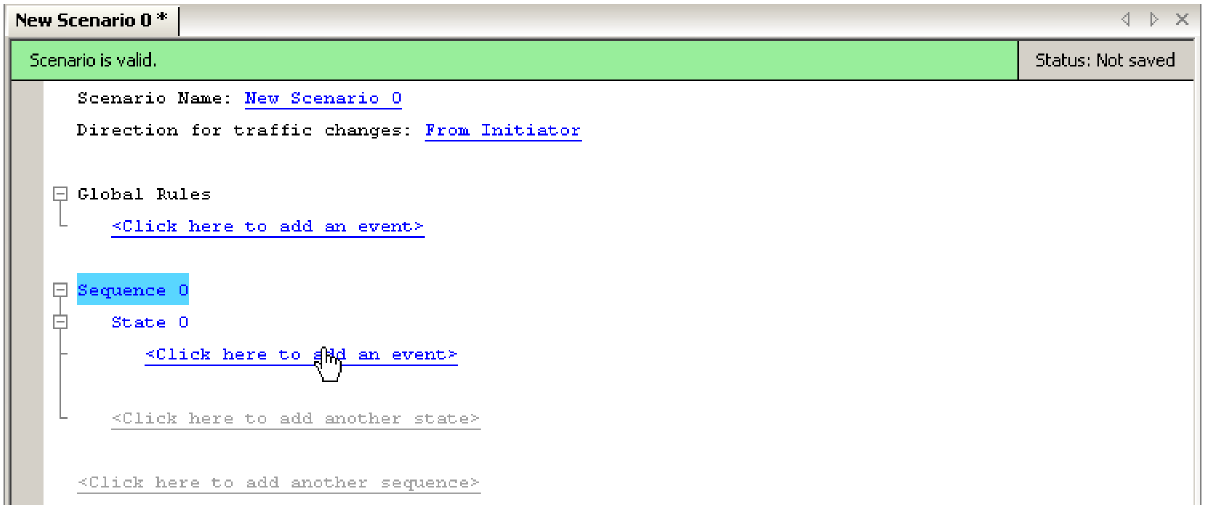
<Click here to add a sequence>

Figure 4.48: Example 7: Adding a Sequence

By default, the name of the first sequence in a scenario is Sequence 0. The name of the first state is State 0. To change the name of a sequence or state, or to associate a description with it, click the name of the sequence or state. A dialog box displays that allows you to enter that information.

Note: The description does not appear on screen, but you can bring it up by clicking the name of the sequence or state.

4. In the State 0 area, click the prompt to **add an event**.



Scenario is valid.

Status: Not saved

Scenario Name: New Scenario 0

Direction for traffic changes: From Initiator

Global Rules

<Click here to add an event>

Sequence 0

State 0

<Click here to add an event>

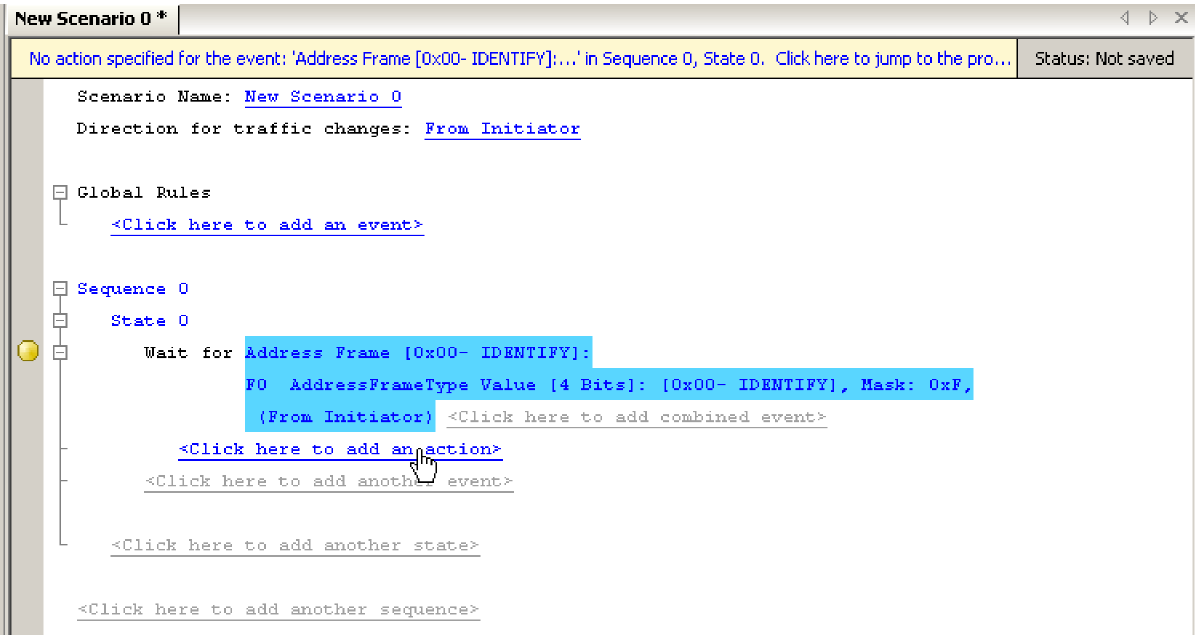
<Click here to add another state>

<Click here to add another sequence>

Figure 4.49: Example 7: Adding an Event for the First State

The Event Properties dialog box displays.

5. In the Event Properties dialog box, select **Address Frame** as the event.
6. Click **OK** to close the Event Properties dialog box.
7. In the State 0 area, click the prompt to **add an action**.



No action specified for the event: 'Address Frame [0x00- IDENTIFY]:...' in Sequence 0, State 0. Click here to jump to the pro...

Status: Not saved

Scenario Name: New Scenario 0

Direction for traffic changes: From Initiator

Global Rules

<Click here to add an event>

Sequence 0

State 0

Wait for Address Frame [0x00- IDENTIFY]:

F0 AddressFrameType Value [4 Bits]: [0x00- IDENTIFY], Mask: 0xF,

(From Initiator) <Click here to add combined event>

<Click here to add an action>

<Click here to add another event>

<Click here to add another state>

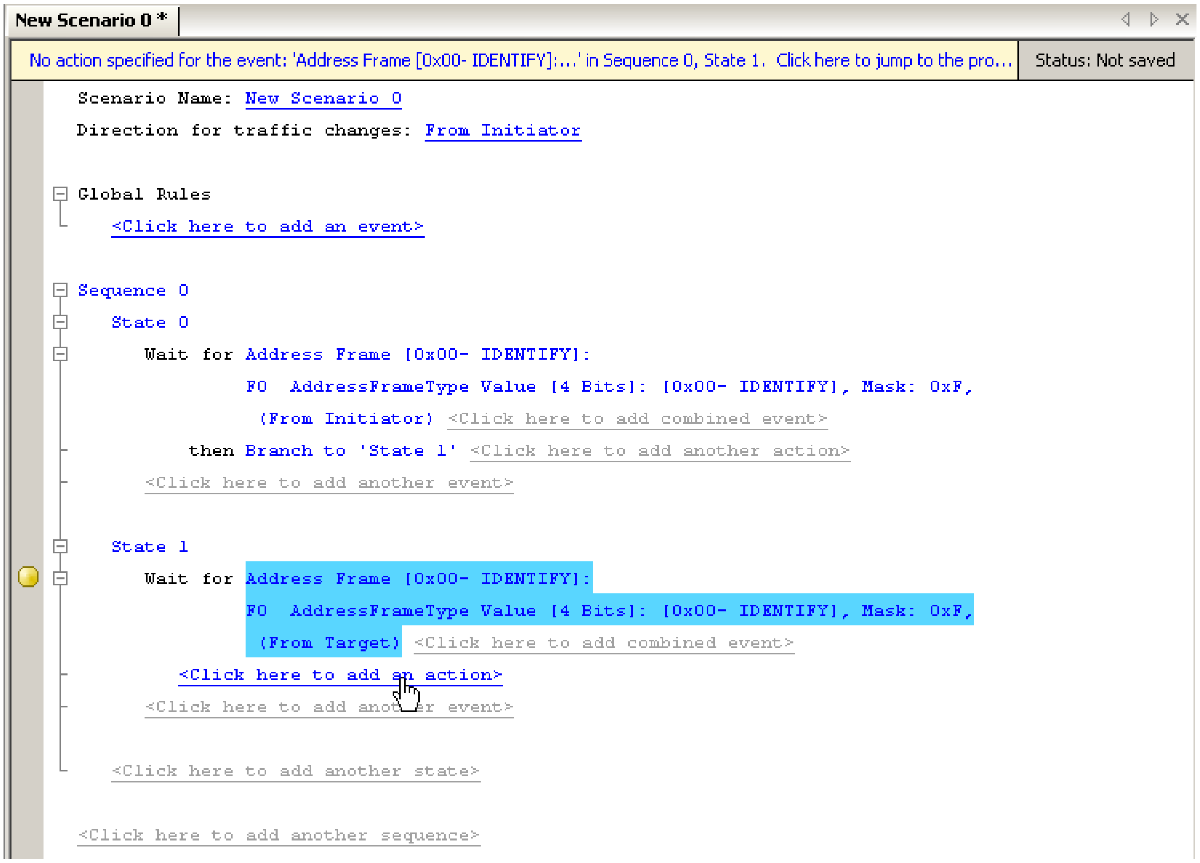
<Click here to add another sequence>

Figure 4.50: Example 7: Adding an Action for the First State

The Action Properties dialog box displays

8. For the action, select **Branch to > New State**.
9. Click the **OK** button to close the Action Properties dialog box.
10. This saves the action and automatically creates an area for State 1 in the scenario.

11. In the State 1 area, click the prompt to **add an event**. The Event Properties dialog box displays.
12. Choose the **Address Frame** event. In the Direction column, select **From Target** (you want State 1 to trigger on an Identify Address frame received from the target).
13. Click **OK** to close the Event Properties dialog box.
14. Click the prompt to **add an action** for State 1.



No action specified for the event: 'Address Frame [0x00- IDENTIFY]:...' in Sequence 0, State 1. Click here to jump to the pro...

Status: Not saved

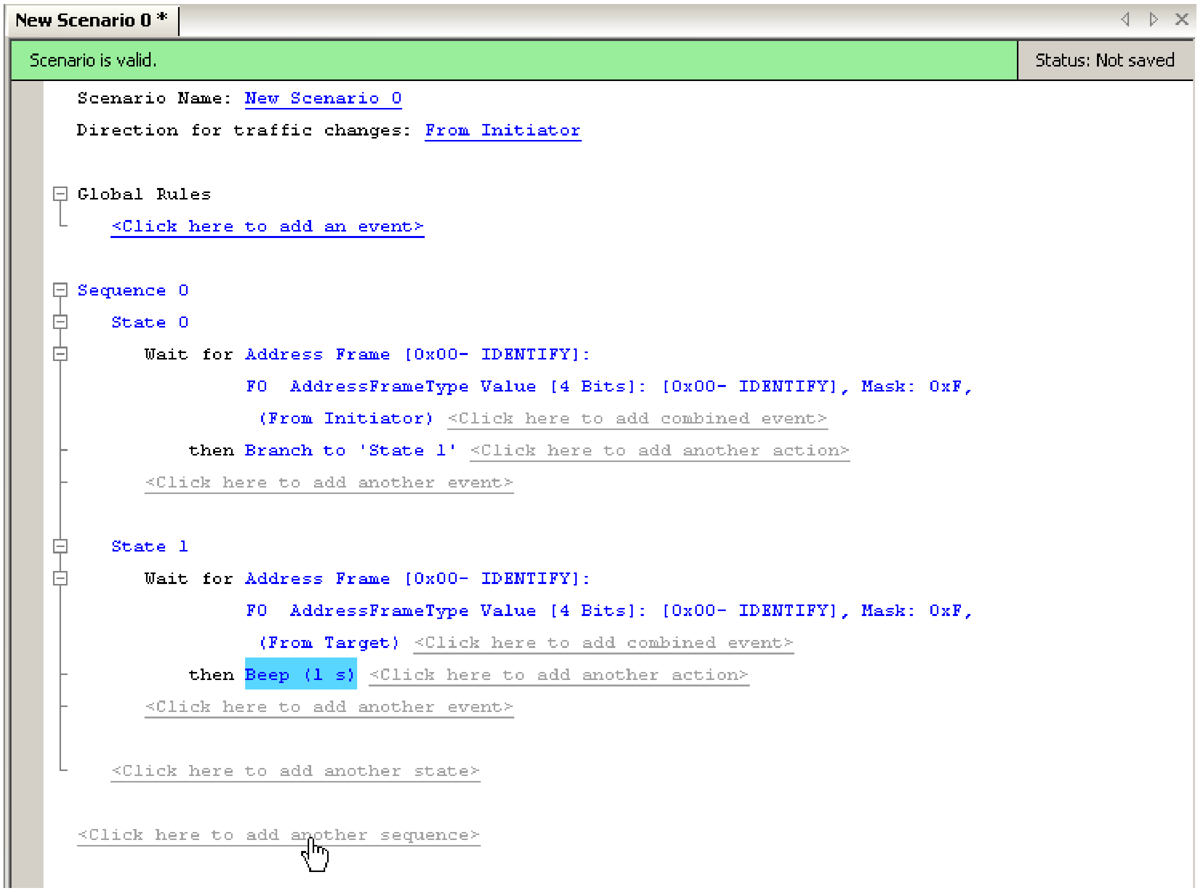
```
Scenario Name: New Scenario 0
Direction for traffic changes: From Initiator

Global Rules
   <Click here to add an event>

Sequence 0
   State 0
      Wait for Address Frame [0x00- IDENTIFY]:
               F0  AddressFrameType Value [4 Bits]: [0x00- IDENTIFY], Mask: 0xF,
                (From Initiator) <Click here to add combined event>
          then Branch to 'State 1' <Click here to add another action>
      <Click here to add another event>

   State 1
      Wait for Address Frame [0x00- IDENTIFY]:
               F0  AddressFrameType Value [4 Bits]: [0x00- IDENTIFY], Mask: 0xF,
                (From Target) <Click here to add combined event>
         <Click here to add an action>
      <Click here to add another event>

   <Click here to add another state>

<Click here to add another sequence>
```

Figure 4.51: Example 7: Adding an Action to the Second State

The Action Properties dialog box displays.

15. In this example, you enter the action **Beep**, and you set the duration of the beep for 1 second.
16. Click **OK** to close the Action Properties dialog box.

17. You are finished creating the first sequence. Click the **add another sequence** prompt to create an area in the scenario for the second sequence (Sequence 1).



Scenario is valid.

Status: Not saved

```
Scenario Name: New Scenario 0
Direction for traffic changes: From Initiator

Global Rules
    <Click here to add an event>

Sequence 0
    State 0
        Wait for Address Frame [0x00- IDENTIFY]:
                 F0  AddressFrameType Value [4 Bits]: [0x00- IDENTIFY], Mask: 0xF,
                  (From Initiator) <Click here to add combined event>
            then Branch to 'State 1' <Click here to add another action>
        <Click here to add another event>

    State 1
        Wait for Address Frame [0x00- IDENTIFY]:
                 F0  AddressFrameType Value [4 Bits]: [0x00- IDENTIFY], Mask: 0xF,
                  (From Target) <Click here to add combined event>
            then Beep (1 s) <Click here to add another action>
        <Click here to add another event>

    <Click here to add another state>

<Click here to add another sequence>
```

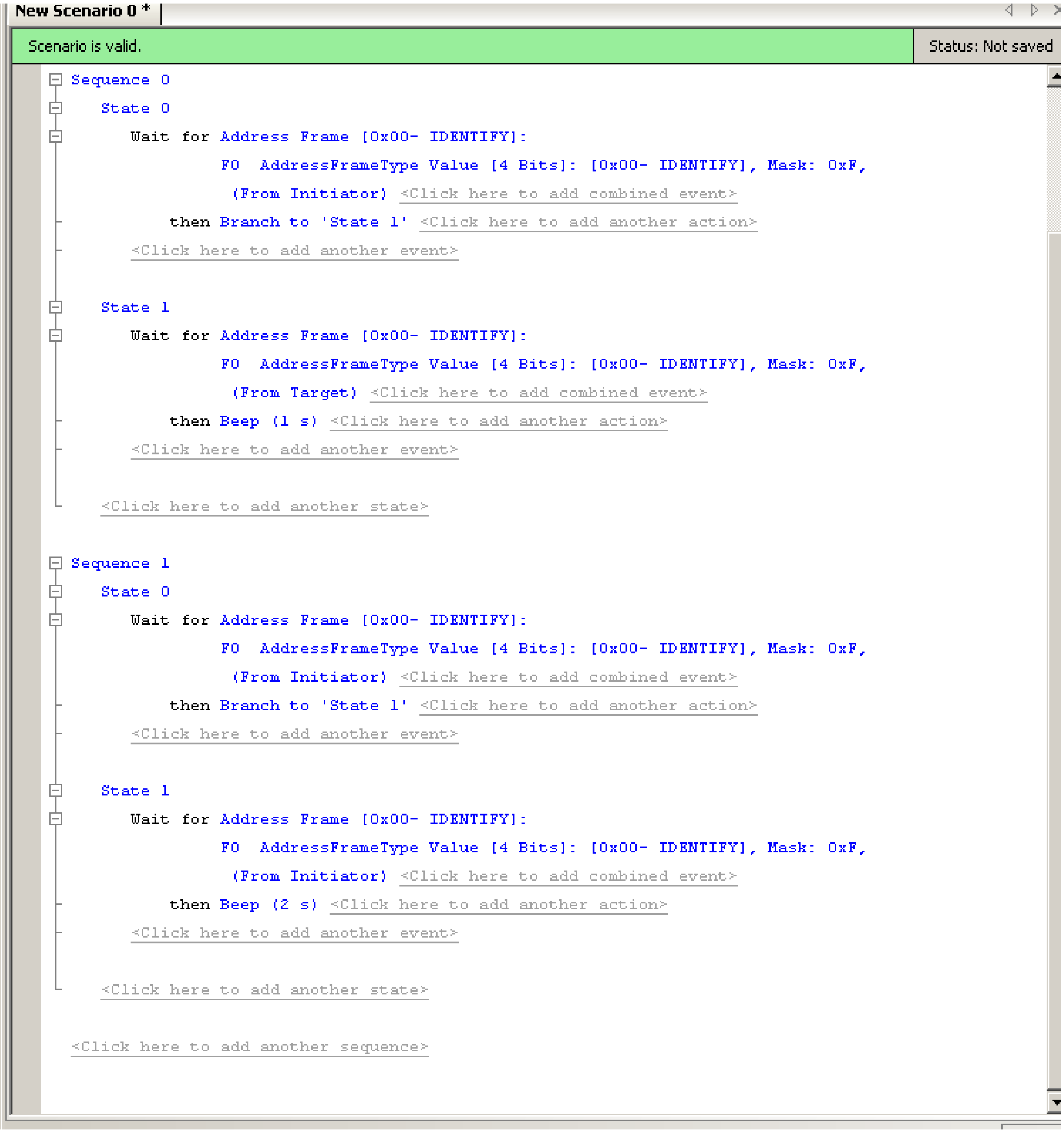
Figure 4.52: Example 7: Adding a Second Sequence

18. Create two states in the second sequence with the characteristics shown in the following table.

TABLE 4.9: Example 7: States for Second Sequence

State	Event	Action
0	Address Frame from Target	Branch to State 1
1	Address Frame from Initiator	Beep for 2 seconds.

19. In the File menu, select **Save Scenario** to save the scenario.



Scenario is valid.

Status: Not saved

```
Sequence 0
    State 0
        Wait for Address Frame [0x00- IDENTIFY]:
                  F0  AddressFrameType Value [4 Bits]: [0x00- IDENTIFY], Mask: 0xF,
                   (From Initiator) <Click here to add combined event>
           then Branch to 'State 1' <Click here to add another action>
        <Click here to add another event>

    State 1
        Wait for Address Frame [0x00- IDENTIFY]:
                  F0  AddressFrameType Value [4 Bits]: [0x00- IDENTIFY], Mask: 0xF,
                   (From Target) <Click here to add combined event>
           then Beep (1 s) <Click here to add another action>
        <Click here to add another event>

    <Click here to add another state>

Sequence 1
    State 0
        Wait for Address Frame [0x00- IDENTIFY]:
                  F0  AddressFrameType Value [4 Bits]: [0x00- IDENTIFY], Mask: 0xF,
                   (From Initiator) <Click here to add combined event>
           then Branch to 'State 1' <Click here to add another action>
        <Click here to add another event>

    State 1
        Wait for Address Frame [0x00- IDENTIFY]:
                  F0  AddressFrameType Value [4 Bits]: [0x00- IDENTIFY], Mask: 0xF,
                   (From Initiator) <Click here to add combined event>
           then Beep (2 s) <Click here to add another action>
        <Click here to add another event>

    <Click here to add another state>

<Click here to add another sequence>
```

Figure 4.53: Example 7: Sequence Area of Scenario

4.10.2 Example 8: Creating a Sequence With Many States #1

In this example, a five-state sequence detects if a group of primitives is received out-of-order from the initiator. The expected order is: Align (0), Align (1), Align (2), Align (3). If this scenario detects any other order of these primitives, it causes the device to beep and the scenario to restart.

This example is designed to give you an idea of the powerful logic that you can implement with sequences.

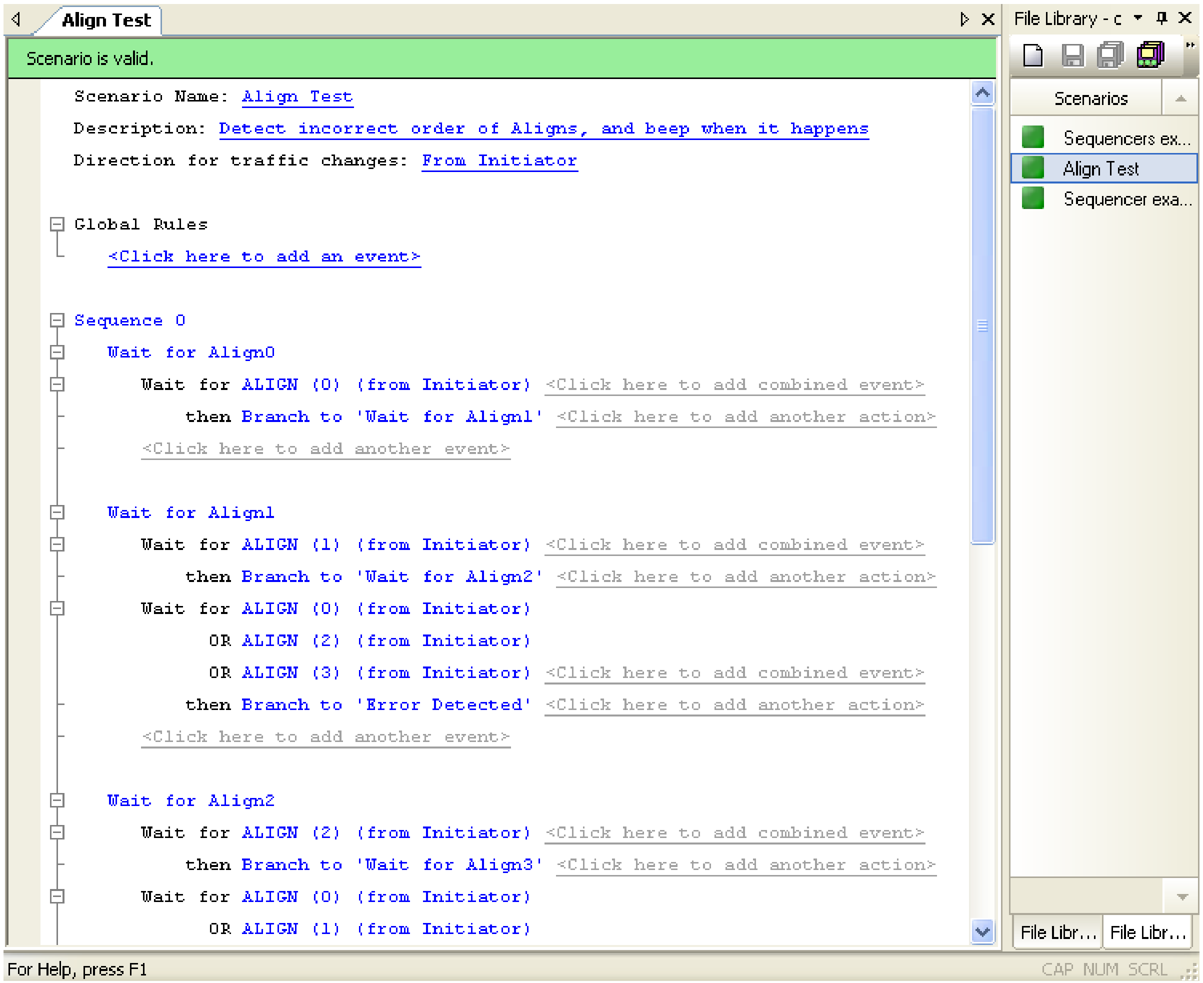
Note that the states in this sequence have been renamed (do not have their default names). The following table summarizes the sequence logic.

TABLE 4.10: Example 8: Logic of Sequence 0

State	Description
Wait for Align (0)	When an Align (0) is received, go to Wait for Align (1).
Wait for Align (1)	If an Align (1) is received next, go to Wait for Align (2); otherwise, go to Indicate Error.
Wait for Align (2)	If an Align (2) is received next, go to Wait for Align (3); otherwise, go to Indicate Error.
Wait for Align (3)	If an Align (3) is received next, restart test; otherwise go to Indicate Error.
Indicate Error	Indicate error and restart test.

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. As in previous examples, create the five states for this sequence.

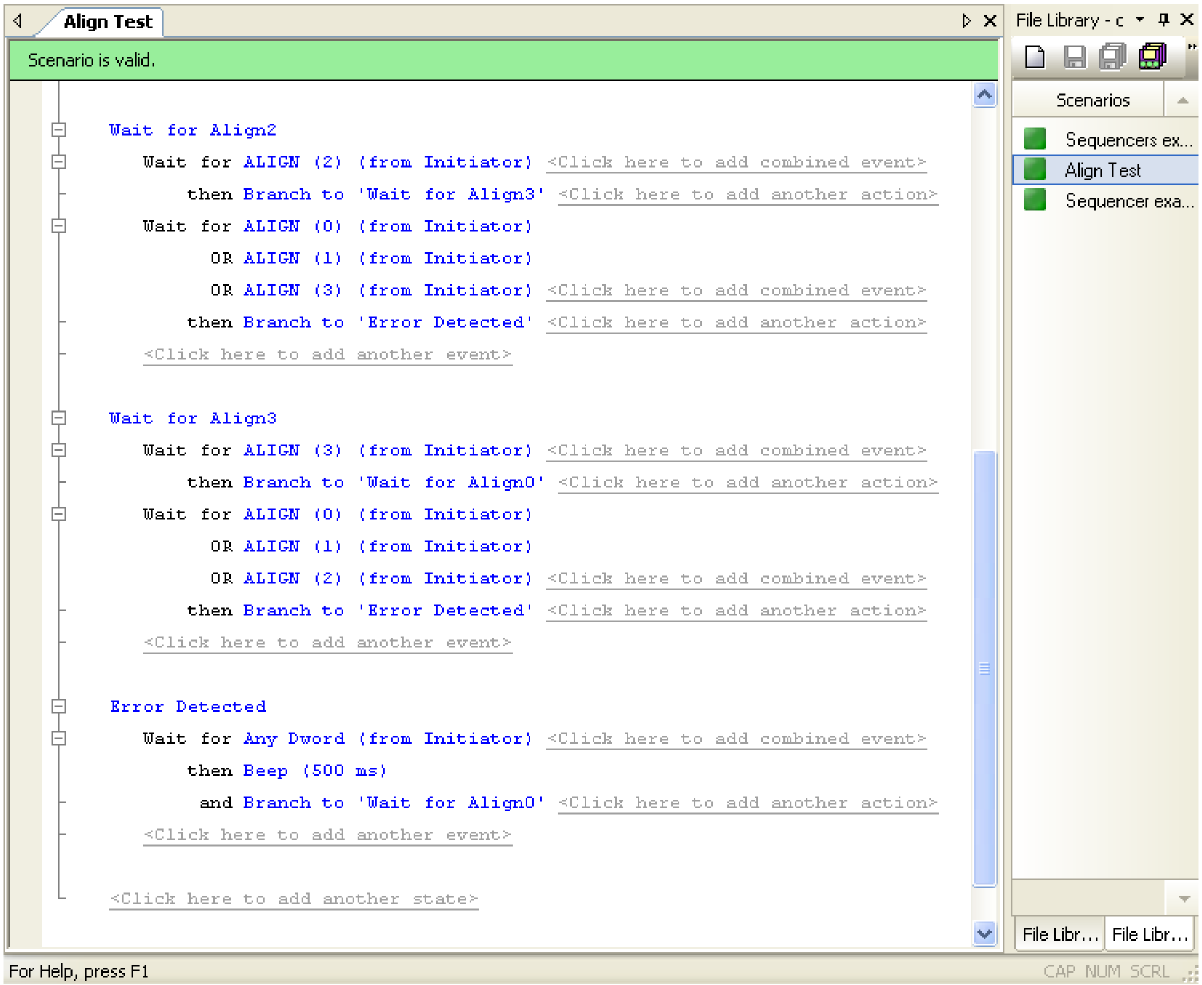
3. In the File menu, select **Save Scenario** to save the scenario.


Align Test
File Library - c
Scenarios
Sequencers ex...
Align Test
Sequencer exa...
File Libr...
File Libr...
For Help, press F1
CAP NUM SCRL

Scenario is valid.

```
Scenario Name: Align Test
Description: Detect incorrect order of Aligns, and beep when it happens
Direction for traffic changes: From Initiator

Global Rules
    <Click here to add an event>

Sequence 0
    Wait for Align0
        Wait for ALIGN (0) (from Initiator) <Click here to add combined event>
            then Branch to 'Wait for Align1' <Click here to add another action>
        <Click here to add another event>

    Wait for Align1
        Wait for ALIGN (1) (from Initiator) <Click here to add combined event>
            then Branch to 'Wait for Align2' <Click here to add another action>
        Wait for ALIGN (0) (from Initiator)
              OR ALIGN (2) (from Initiator)
              OR ALIGN (3) (from Initiator) <Click here to add combined event>
            then Branch to 'Error Detected' <Click here to add another action>
        <Click here to add another event>

    Wait for Align2
        Wait for ALIGN (2) (from Initiator) <Click here to add combined event>
            then Branch to 'Wait for Align3' <Click here to add another action>
        Wait for ALIGN (0) (from Initiator)
              OR ALIGN (1) (from Initiator)
```

Figure 4.54: Example 8: Top Half of Scenario


Align Test
File Library - c
Scenarios
Sequencers ex...
Align Test
Sequencer exa...
File Libr...
File Libr...
For Help, press F1
CAP NUM SCRL

Scenario is valid.

```
Wait for Align2
    Wait for ALIGN (2) (from Initiator) <Click here to add combined event>
        then Branch to 'Wait for Align3' <Click here to add another action>
    Wait for ALIGN (0) (from Initiator)
          OR ALIGN (1) (from Initiator)
          OR ALIGN (3) (from Initiator) <Click here to add combined event>
        then Branch to 'Error Detected' <Click here to add another action>
    <Click here to add another event>

Wait for Align3
    Wait for ALIGN (3) (from Initiator) <Click here to add combined event>
        then Branch to 'Wait for Align0' <Click here to add another action>
    Wait for ALIGN (0) (from Initiator)
          OR ALIGN (1) (from Initiator)
          OR ALIGN (2) (from Initiator) <Click here to add combined event>
        then Branch to 'Error Detected' <Click here to add another action>
    <Click here to add another event>

Error Detected
    Wait for Any Dword (from Initiator) <Click here to add combined event>
        then Beep (500 ms)
         and Branch to 'Wait for Align0' <Click here to add another action>
    <Click here to add another event>

<Click here to add another state>
```

Figure 4.55: Example 8: Bottom Half of Scenario

4.10.3 Example 9: Creating a Sequence With Many States #2

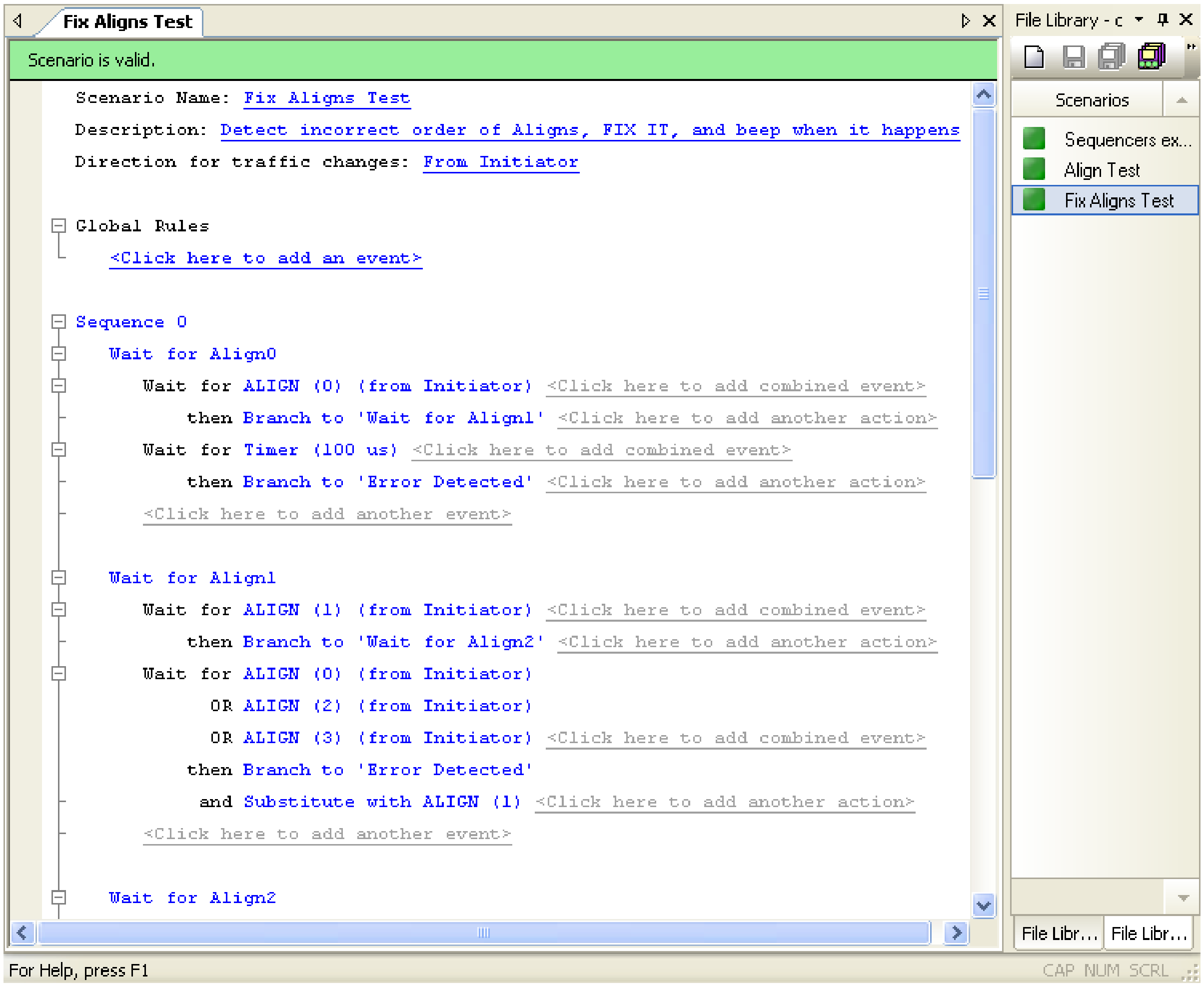
In this example, a five-state sequence not only detects if a group of primitives is received out-of-order, but it fixes any incorrect order. The logic is similar to that of example 8 with a few small changes. The following table summarizes each state.

TABLE 4.11: Example 9: Logic of Sequence 0

State	Description
Wait for Align (0)	When an Align (0) is received, go to Wait for Align (1).
Wait for Align (1)	If an Align (1) is received next, go to Wait for Align (2); otherwise, replace primitive with Align (1) and go to Indicate Error.
Wait for Align (2)	If an Align (2) is received next, go to Wait for Align (3); otherwise, replace primitive with Align (2) and go to Indicate Error.
Wait for Align (3)	If an Align (3) is received next, restart test; otherwise, replace primitive with Align (3) and go to Indicate Error.
Indicate Error	Indicate error and restart test.

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. As in previous examples, create the five states for this sequence.

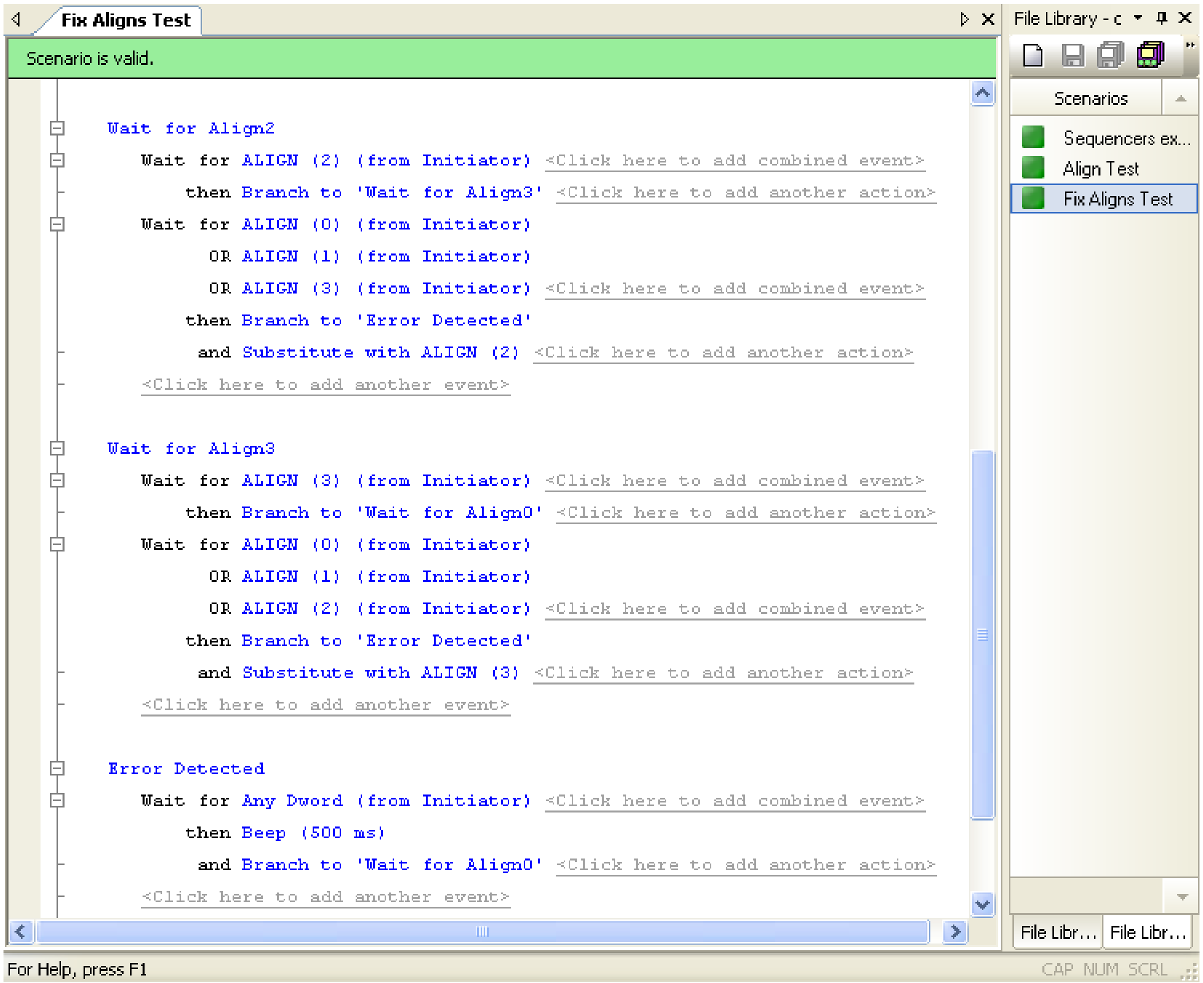
3. In the File menu, select **Save Scenario** to save the scenario.


Fix Aligns Test
File Library - c
Scenarios
Sequencers ex...
Align Test
Fix Aligns Test
File Libr...
File Libr...
For Help, press F1
CAP NUM SCRL

Scenario is valid.

```
Scenario Name: Fix Aligns Test
Description: Detect incorrect order of Aligns, FIX IT, and beep when it happens
Direction for traffic changes: From Initiator

Global Rules
    <Click here to add an event>

Sequence 0
    Wait for Align0
        Wait for ALIGN (0) (from Initiator) <Click here to add combined event>
            then Branch to 'Wait for Align1' <Click here to add another action>
        Wait for Timer (100 us) <Click here to add combined event>
            then Branch to 'Error Detected' <Click here to add another action>
        <Click here to add another event>

    Wait for Align1
        Wait for ALIGN (1) (from Initiator) <Click here to add combined event>
            then Branch to 'Wait for Align2' <Click here to add another action>
        Wait for ALIGN (0) (from Initiator)
              OR ALIGN (2) (from Initiator)
              OR ALIGN (3) (from Initiator) <Click here to add combined event>
            then Branch to 'Error Detected'
             and Substitute with ALIGN (1) <Click here to add another action>
        <Click here to add another event>

    Wait for Align2
```

Figure 4.56: Example 9: Top Half of Scenario


Fix Aligns Test
File Library - c
Scenarios
Sequencers ex...
Align Test
Fix Aligns Test
File Libr...
File Libr...
For Help, press F1
CAP NUM SCRL

Scenario is valid.

```
Wait for Align2
   Wait for ALIGN (2) (from Initiator) <Click here to add combined event>
       then Branch to 'Wait for Align3' <Click here to add another action>
   Wait for ALIGN (0) (from Initiator)
         OR ALIGN (1) (from Initiator)
         OR ALIGN (3) (from Initiator) <Click here to add combined event>
       then Branch to 'Error Detected'
        and Substitute with ALIGN (2) <Click here to add another action>
   <Click here to add another event>

Wait for Align3
   Wait for ALIGN (3) (from Initiator) <Click here to add combined event>
       then Branch to 'Wait for Align0' <Click here to add another action>
   Wait for ALIGN (0) (from Initiator)
         OR ALIGN (1) (from Initiator)
         OR ALIGN (2) (from Initiator) <Click here to add combined event>
       then Branch to 'Error Detected'
        and Substitute with ALIGN (3) <Click here to add another action>
   <Click here to add another event>

Error Detected
   Wait for Any Dword (from Initiator) <Click here to add combined event>
       then Beep (500 ms)
        and Branch to 'Wait for Align0' <Click here to add another action>
   <Click here to add another event>
```

Figure 4.57: Example 9: Bottom Half of Scenario

4.11 Running Scenarios

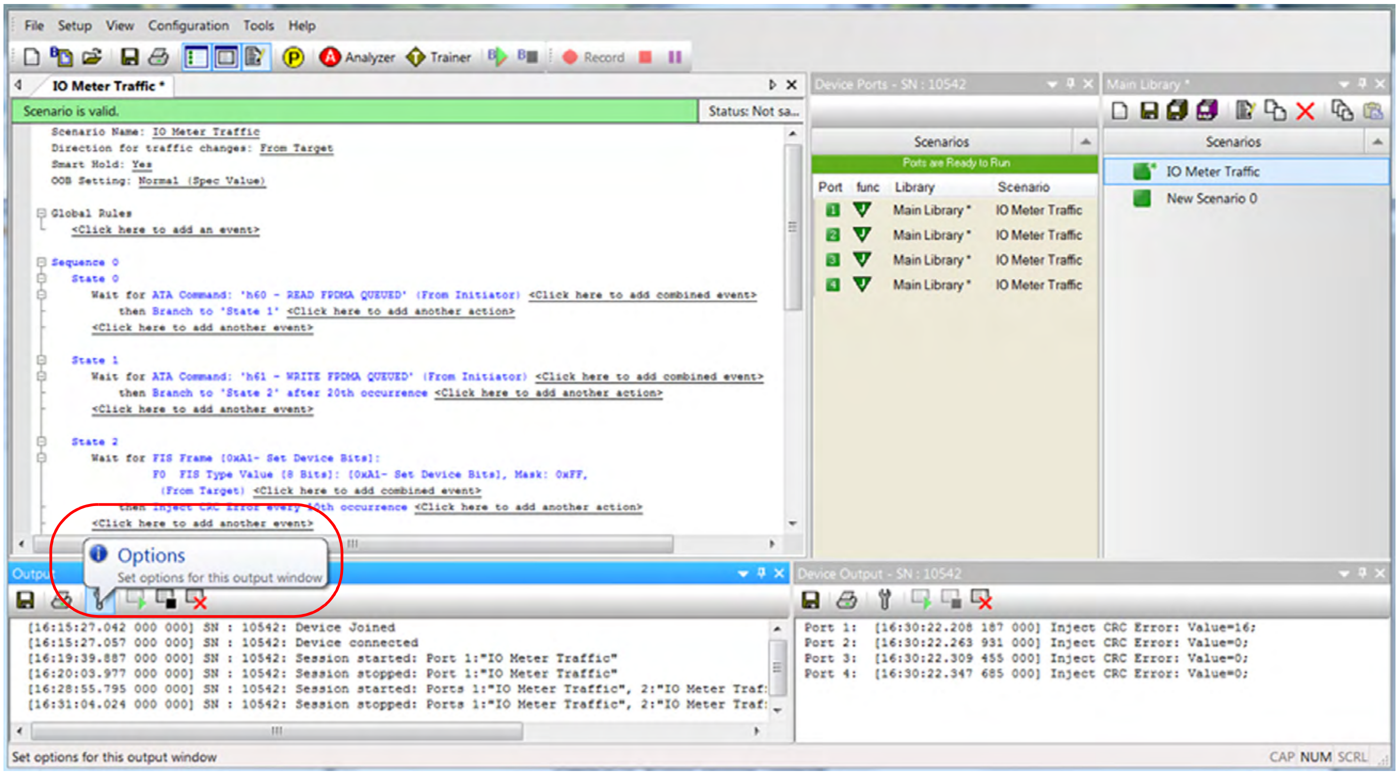
If you use a general library as a scenario archive, then the process of executing a scenario is as follows:

1. Select the scenario to run by clicking it.
2. To run the scenario, click the **Run Scenario** button on the Device Library toolbar (second button from the right). The InFusion device then begins its session.

4.12 Saving a Log File

To save a log file of a Jammer or Device Output, select the wrench from the toolbar below the Scenario window (see Figure 4.58) or below the Device window (see Figure 4.60 on page 343).

Option to Save Output Window Log File


File
Setup
View
Configuration
Tools
Help
Analyzer
Trainer
Record
IO Meter Traffic *
Scenario is valid.
Status: Not sa...
Device Ports - SN : 10542
Scenarios
Ports are Ready to Run
Main Library *
Scenarios
IO Meter Traffic
New Scenario 0
Options
Set options for this output window
Outpu
Device Output - SN : 10542
Set options for this output window
CAP
NUM
SCRL

```
Scenario Name: IO Meter Traffic
Direction for traffic changes: From Target
Smart Hold: Yes
OOB Setting: Normal (Spec Value)

Global Rules
    <Click here to add an event>

Sequence 0
    State 0
        Wait for ATA Command: 'h60 - READ FPDMA QUEUED' (From Initiator) <Click here to add combined event>
            then Branch to 'State 1' <Click here to add another action>
        <Click here to add another event>

    State 1
        Wait for ATA Command: 'h61 - WRITE FPDMA QUEUED' (From Initiator) <Click here to add combined event>
            then Branch to 'State 2' after 20th occurrence <Click here to add another action>
        <Click here to add another event>

    State 2
        Wait for FIS Frame [0xA1- Set Device Bits]:
                F0  FIS Type Value [8 Bits]: [0xA1- Set Device Bits], Mask: 0xFF,
                 (From Target) <Click here to add combined event>
            then Inject CRC Error every 10th occurrence <Click here to add another action>
        <Click here to add another event>
```

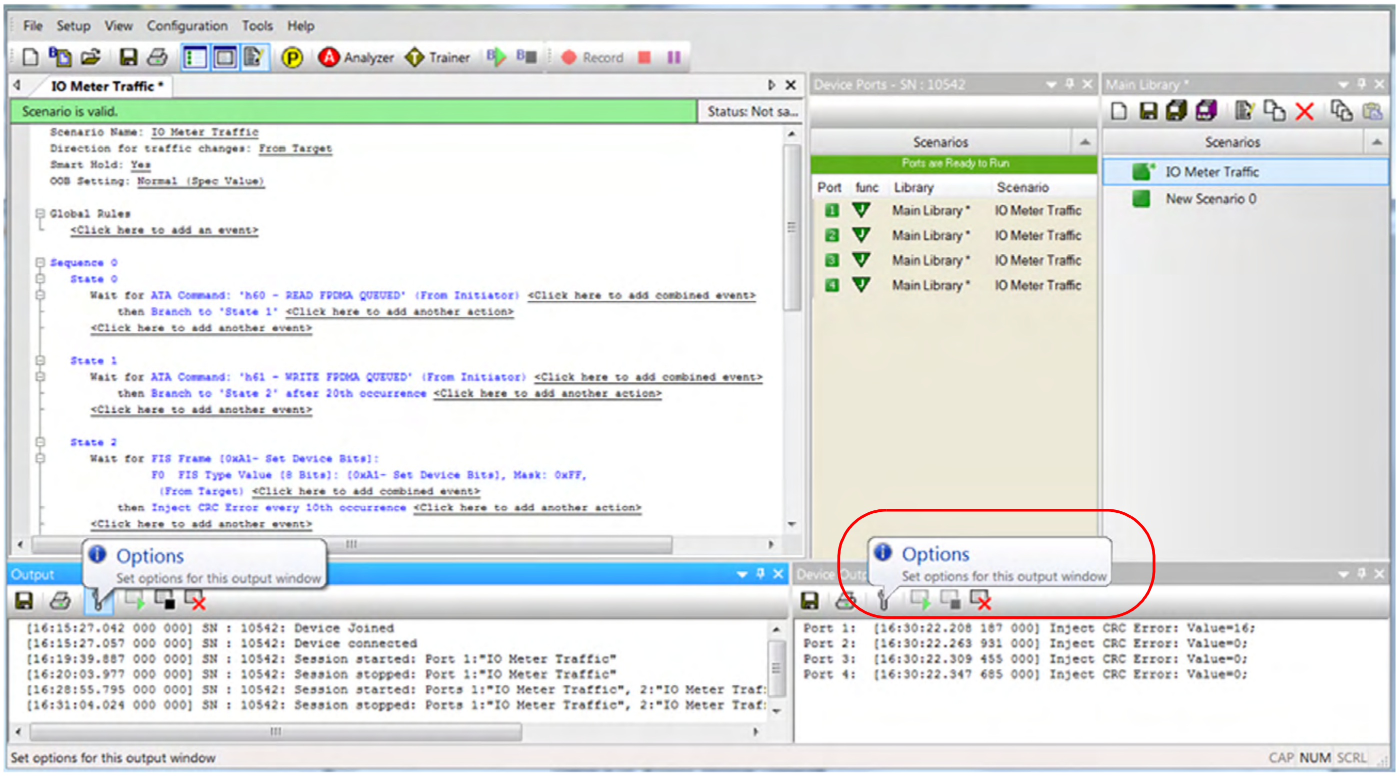
Port	func	Library	Scenario
1	▽	Main Library *	IO Meter Traffic
2	▽	Main Library *	IO Meter Traffic
3	▽	Main Library *	IO Meter Traffic
4	▽	Main Library *	IO Meter Traffic

```
[16:15:27.042 000 000] SN : 10542: Device Joined
[16:15:27.057 000 000] SN : 10542: Device connected
[16:19:39.887 000 000] SN : 10542: Session started: Port 1:"IO Meter Traffic"
[16:20:03.977 000 000] SN : 10542: Session stopped: Port 1:"IO Meter Traffic"
[16:28:55.795 000 000] SN : 10542: Session started: Ports 1:"IO Meter Traffic", 2:"IO Meter Traf:
[16:31:04.024 000 000] SN : 10542: Session stopped: Ports 1:"IO Meter Traffic", 2:"IO Meter Traf:
```

```
Port 1:   [16:30:22.208 187 000] Inject CRC Error: Value=16;
Port 2:   [16:30:22.263 931 000] Inject CRC Error: Value=0;
Port 3:   [16:30:22.309 455 000] Inject CRC Error: Value=0;
Port 4:   [16:30:22.347 685 000] Inject CRC Error: Value=0;
```

Figure 4.58: Output Window Options

Option to Save Device Output Window Log File


File Setup View Configuration Tools Help
Analyzer
Trainer
Record
IO Meter Traffic *
Status: Not sa...
Device Ports - SN : 10542
Scenarios
Ports are Ready to Run
Port func Library Scenario
Main Library * IO Meter Traffic
Main Library * IO Meter Traffic
Main Library * IO Meter Traffic
Main Library * IO Meter Traffic
Main Library *
Scenarios
IO Meter Traffic
New Scenario 0
Options
Set options for this output window
Output
Options
Set options for this output window
Device Outp
Set options for this output window
CAP NUM SCRL

Scenario is valid.

```
Scenario Name: IO Meter Traffic
Direction for traffic changes: From Target
Smart Hold: Yes
OOB Setting: Normal (Spec Value)

Global Rules
   <Click here to add an event>

Sequence 0
   State 0
      Wait for ATA Command: 'h60 - READ FPDMA QUEUED' (From Initiator) <Click here to add combined event>
          then Branch to 'State 1' <Click here to add another action>
      <Click here to add another event>

   State 1
      Wait for ATA Command: 'h61 - WRITE FPDMA QUEUED' (From Initiator) <Click here to add combined event>
          then Branch to 'State 2' after 20th occurrence <Click here to add another action>
      <Click here to add another event>

   State 2
      Wait for FIS Frame [0xA1- Set Device Bits]:
               F0  FIS Type Value [8 Bits]: [0xA1- Set Device Bits], Mask: 0xFF,
                (From Target) <Click here to add combined event>
          then Inject CRC Error every 10th occurrence <Click here to add another action>
      <Click here to add another event>
```

```
[16:15:27.042 000 000] SN : 10542: Device Joined
[16:15:27.057 000 000] SN : 10542: Device connected
[16:19:39.887 000 000] SN : 10542: Session started: Port 1:"IO Meter Traffic"
[16:20:03.977 000 000] SN : 10542: Session stopped: Port 1:"IO Meter Traffic"
[16:28:55.795 000 000] SN : 10542: Session started: Ports 1:"IO Meter Traffic", 2:"IO Meter Traf:
[16:31:04.024 000 000] SN : 10542: Session stopped: Ports 1:"IO Meter Traffic", 2:"IO Meter Traf:
```

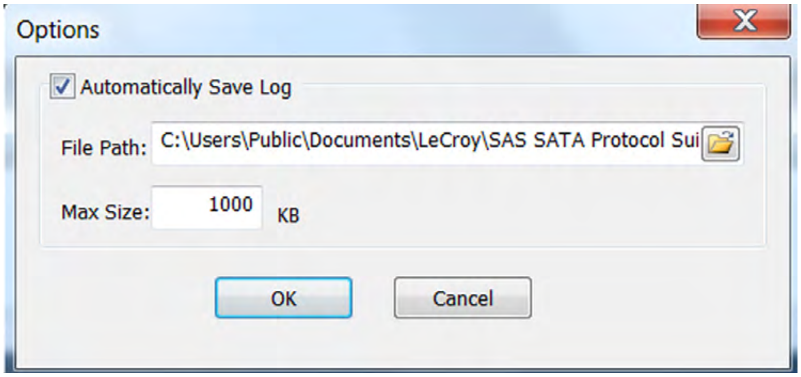
```
Port 1:   [16:30:22.208 187 000] Inject CRC Error: Value=16;
Port 2:   [16:30:22.263 931 000] Inject CRC Error: Value=0;
Port 3:   [16:30:22.309 455 000] Inject CRC Error: Value=0;
Port 4:   [16:30:22.347 685 000] Inject CRC Error: Value=0;
```

Set options for this output window

Figure 4.59: Device Output Window Options

Automatically Save Log File

Selecting either “Wrench”will pop up a window which automatically stores the log file for the Window selected. See Figure 4.60.


Options
OK
Cancel

☑ Automatically Save Log

File Path: C:\Users\Public\Documents\LeCroy\SAS SATA Protocol Sui

Max Size: 1000 KB

Figure 4.60: Auto Save Log File: Location and Size

You can change the maximum size of the log file by typing in the Max Size window. If you select the folder, you can change the path to the location of the log file. See Figure 4.61 on page 344.

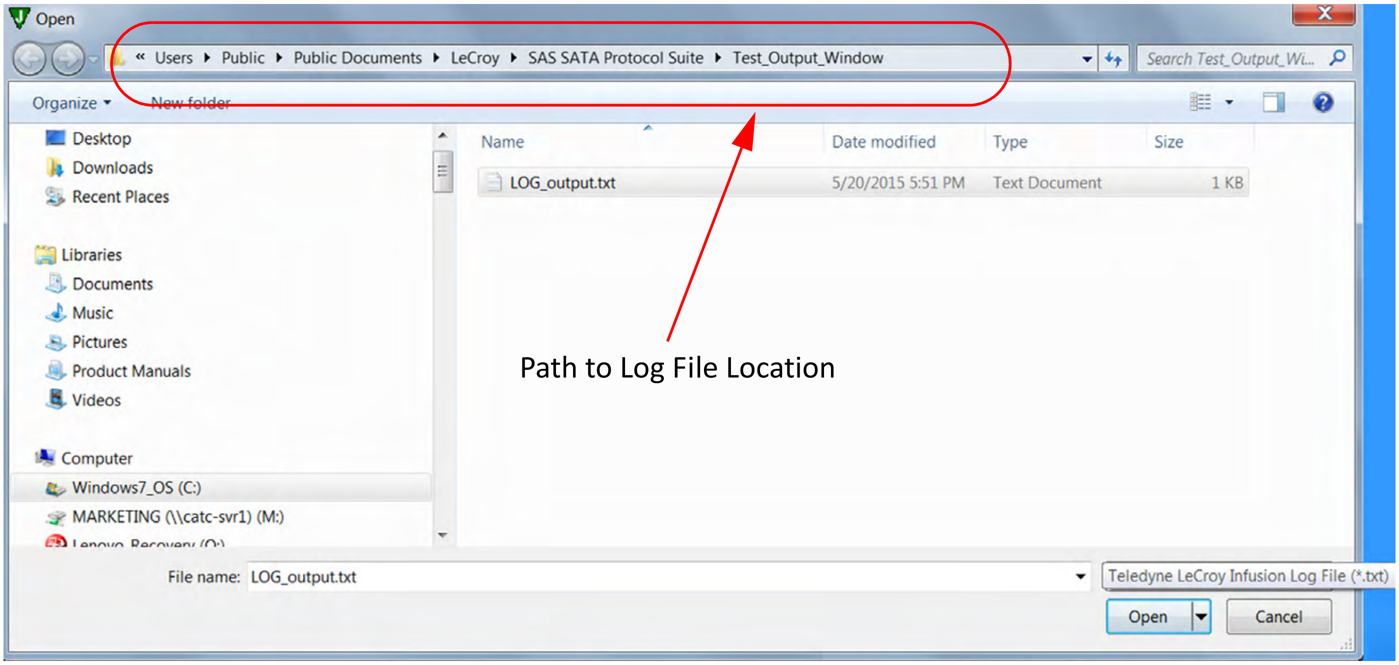
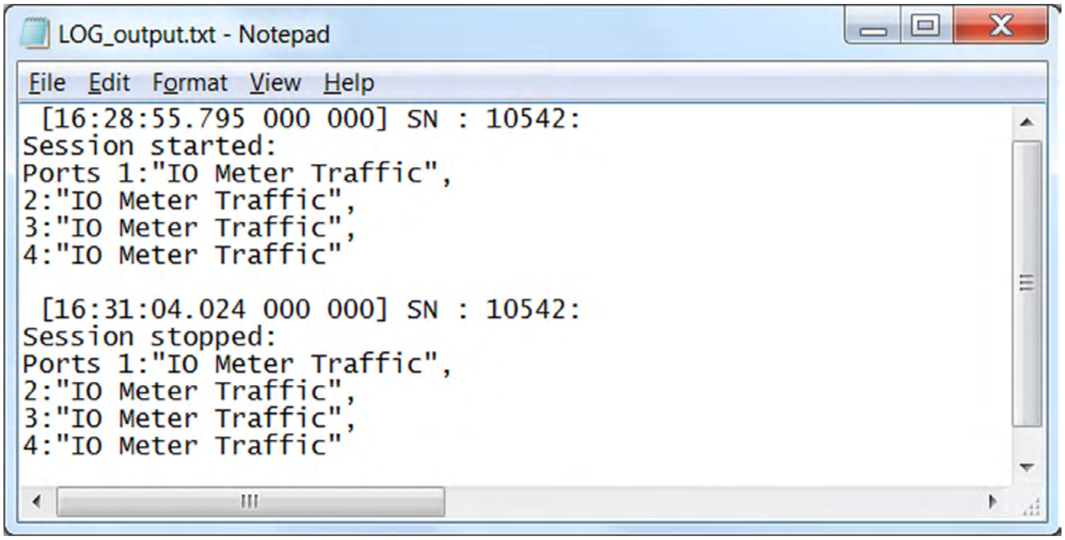
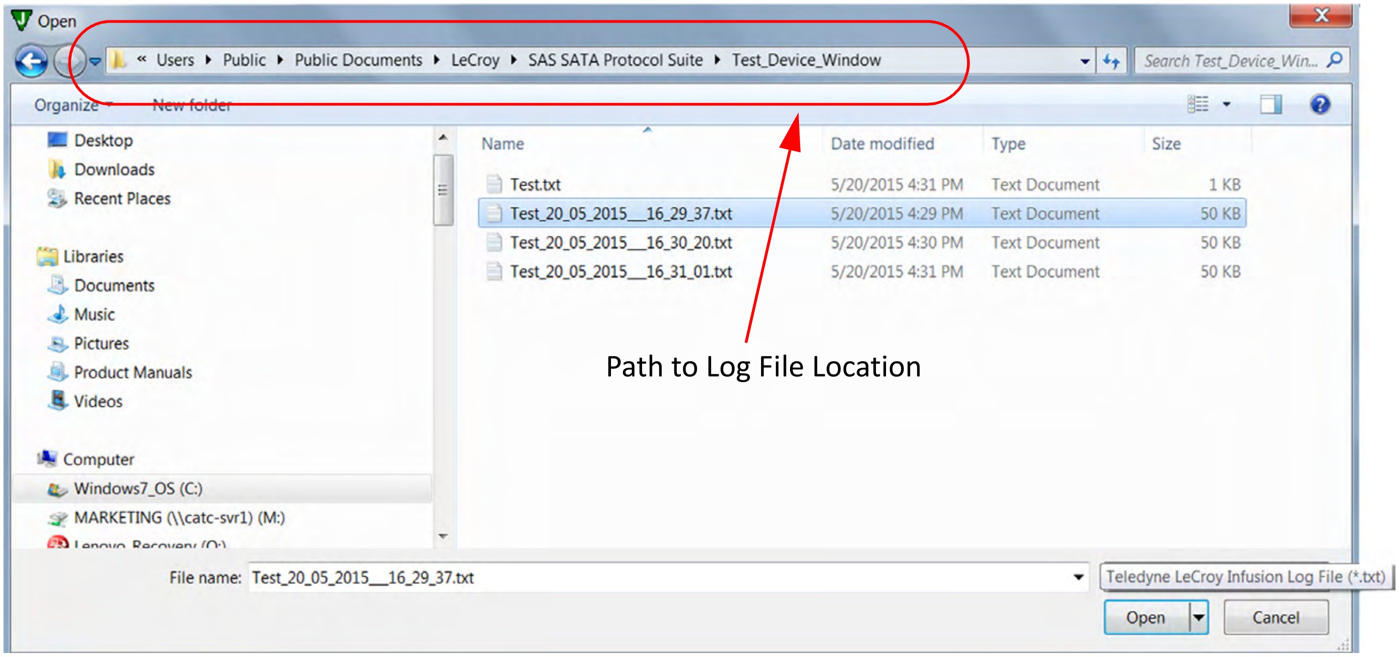

Open
« Users ▸ Public ▸ Public Documents ▸ LeCroy ▸ SAS SATA Protocol Suite ▸ Test_Output_Window
Search Test_Output_Wi...
Organize ▾
New folder
Desktop
Downloads
Recent Places
Libraries
Documents
Music
Pictures
Product Manuals
Videos
Computer
Windows7_OS (C:)
MARKETING (\\catc-svr1) (M:)
Lenovo Recovery (Q:)
Name
Date modified
Type
Size
LOG_output.txt
5/20/2015 5:51 PM
Text Document
1 KB
Path to Log File Location
File name:
LOG_output.txt
Teledyne LeCroy Infusion Log File (*.txt)
Open
Cancel

Figure 4.61: User Defined Location of Jammer Output Window Log File


LOG_output.txt - Notepad
File Edit Format View Help

```
 [16:28:55.795 000 000] SN : 10542:
Session started:
Ports 1:"IO Meter Traffic",
2:"IO Meter Traffic",
3:"IO Meter Traffic",
4:"IO Meter Traffic"

 [16:31:04.024 000 000] SN : 10542:
Session stopped:
Ports 1:"IO Meter Traffic",
2:"IO Meter Traffic",
3:"IO Meter Traffic",
4:"IO Meter Traffic"
```

Figure 4.62: Sample Jammer Output Log File


Open
Organize
New folder
Desktop
Downloads
Recent Places
Libraries
Documents
Music
Pictures
Product Manuals
Videos
Computer
Windows7_OS (C:)
MARKETING (\\catc-svr1) (M:)
Lenovo Recovery (Q:)
Search Test_Device_Win...
Open
Cancel
Path to Log File Location

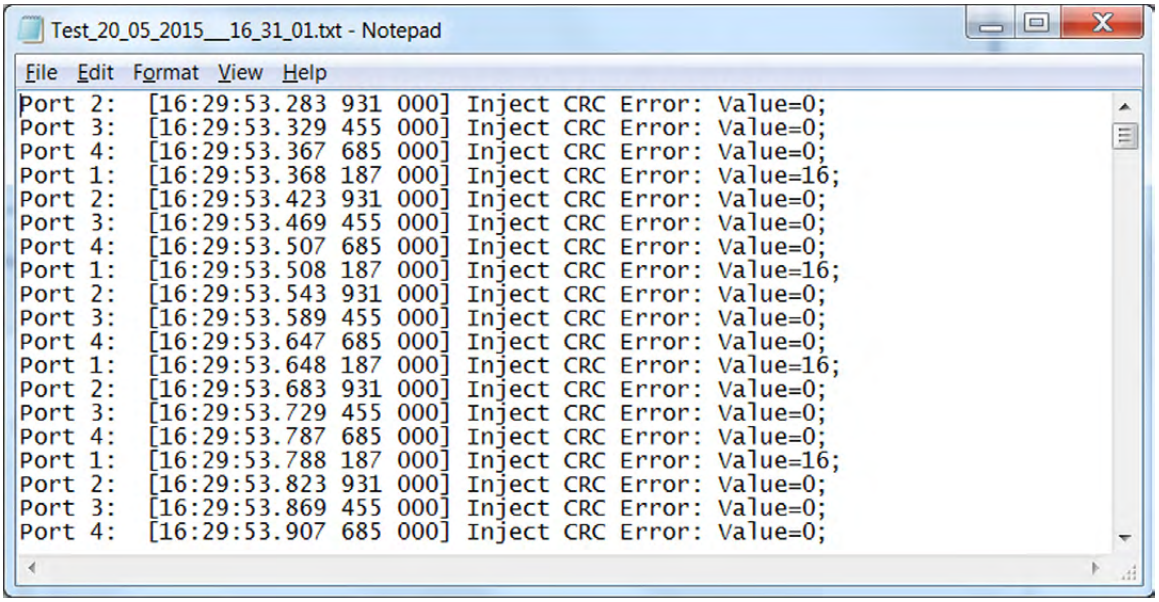
« Users ▸ Public ▸ Public Documents ▸ LeCroy ▸ SAS SATA Protocol Suite ▸ Test_Device_Window

Name	Date modified	Type	Size
Test.txt	5/20/2015 4:31 PM	Text Document	1 KB
Test_20_05_2015__16_29_37.txt	5/20/2015 4:29 PM	Text Document	50 KB
Test_20_05_2015__16_30_20.txt	5/20/2015 4:30 PM	Text Document	50 KB
Test_20_05_2015__16_31_01.txt	5/20/2015 4:31 PM	Text Document	50 KB

File name: Test_20_05_2015__16_29_37.txt

Teledyne LeCroy Infusion Log File (*.txt)

Figure 4.63: User Defined Location of Device Output Window Log File

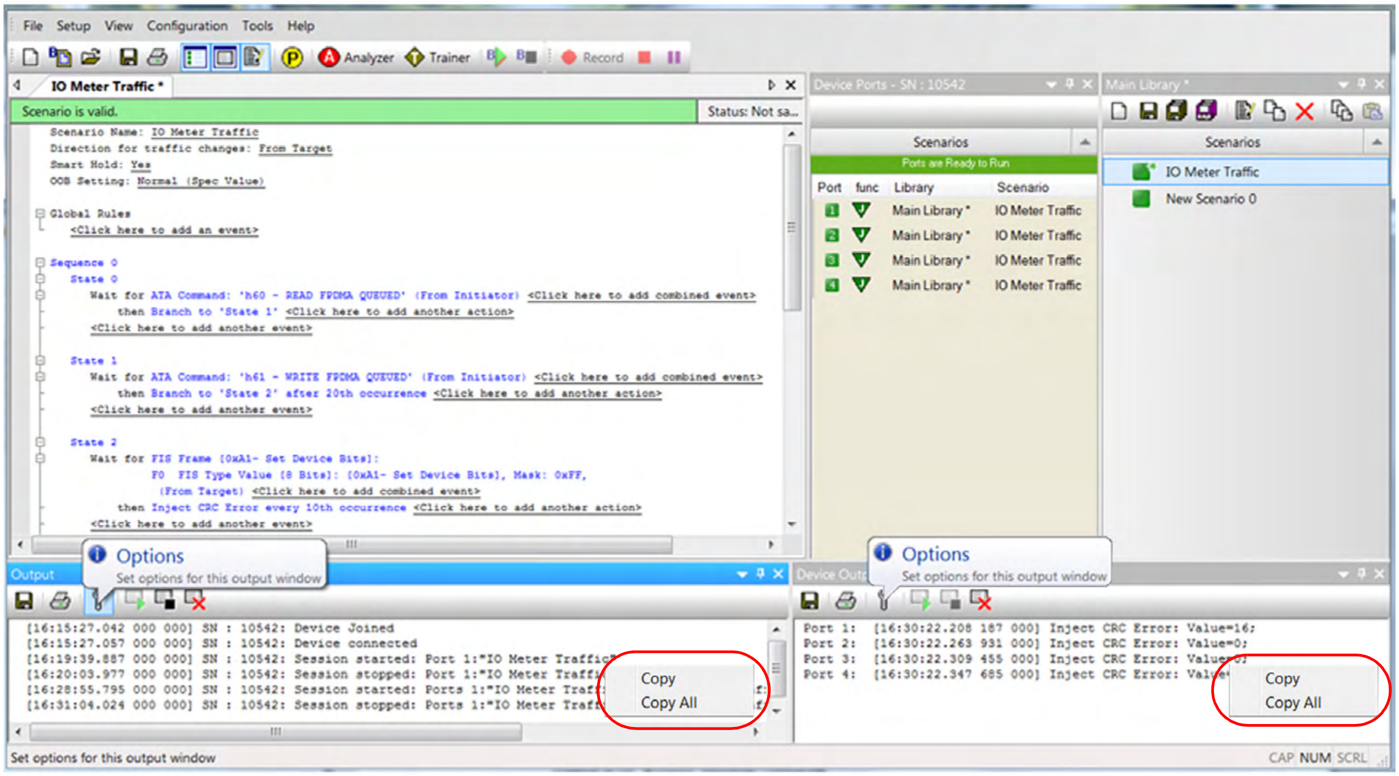

Test_20_05_2015__16_31_01.txt - Notepad
File Edit Format View Help

```
Port 2:  [16:29:53.283 931 000] Inject CRC Error: Value=0;
Port 3:  [16:29:53.329 455 000] Inject CRC Error: Value=0;
Port 4:  [16:29:53.367 685 000] Inject CRC Error: Value=0;
Port 1:  [16:29:53.368 187 000] Inject CRC Error: Value=16;
Port 2:  [16:29:53.423 931 000] Inject CRC Error: Value=0;
Port 3:  [16:29:53.469 455 000] Inject CRC Error: Value=0;
Port 4:  [16:29:53.507 685 000] Inject CRC Error: Value=0;
Port 1:  [16:29:53.508 187 000] Inject CRC Error: Value=16;
Port 2:  [16:29:53.543 931 000] Inject CRC Error: Value=0;
Port 3:  [16:29:53.589 455 000] Inject CRC Error: Value=0;
Port 4:  [16:29:53.647 685 000] Inject CRC Error: Value=0;
Port 1:  [16:29:53.648 187 000] Inject CRC Error: Value=16;
Port 2:  [16:29:53.683 931 000] Inject CRC Error: Value=0;
Port 3:  [16:29:53.729 455 000] Inject CRC Error: Value=0;
Port 4:  [16:29:53.787 685 000] Inject CRC Error: Value=0;
Port 1:  [16:29:53.788 187 000] Inject CRC Error: Value=16;
Port 2:  [16:29:53.823 931 000] Inject CRC Error: Value=0;
Port 3:  [16:29:53.869 455 000] Inject CRC Error: Value=0;
Port 4:  [16:29:53.907 685 000] Inject CRC Error: Value=0;
```

Figure 4.64: Sample Device Output Log File

Copy or Copy All

Another method to capture and save the log file is to simply perform a right click in the log Output Window or Device Window. Then select a portion of the log file to Copy or Copy All. See Figure 4.65.


File
Setup
View
Configuration
Tools
Help
Analyzer
Trainer
Record
IO Meter Traffic *
Scenario is valid.
Status: Not sa...
Device Ports - SN : 10542
Scenarios
Ports are Ready to Run
Main Library *
Scenarios
IO Meter Traffic
New Scenario 0
Options
Set options for this output window
Output
Device Outp
Options
Set options for this output window
Copy
Copy All
Copy
Copy All
Set options for this output window
CAP NUM SCRL

```
Scenario Name: IO Meter Traffic
Direction for traffic changes: From Target
Smart Hold: Yes
OOB Setting: Normal (Spec Value)

Global Rules
   <Click here to add an event>

Sequence 0
   State 0
      Wait for ATA Command: 'h60 - READ FPDMA QUEUED' (From Initiator) <Click here to add combined event>
          then Branch to 'State 1' <Click here to add another action>
      <Click here to add another event>

   State 1
      Wait for ATA Command: 'h61 - WRITE FPDMA QUEUED' (From Initiator) <Click here to add combined event>
          then Branch to 'State 2' after 20th occurrence <Click here to add another action>
      <Click here to add another event>

   State 2
      Wait for FIS Frame [0xA1- Set Device Bits]:
               F0  FIS Type Value (8 Bits): [0xA1- Set Device Bits], Mask: 0xFF,
                (From Target) <Click here to add combined event>
          then Inject CRC Error every 10th occurrence <Click here to add another action>
      <Click here to add another event>
```

Port	func	Library	Scenario
1	▽	Main Library *	IO Meter Traffic
2	▽	Main Library *	IO Meter Traffic
3	▽	Main Library *	IO Meter Traffic
4	▽	Main Library *	IO Meter Traffic

```
[16:15:27.042 000 000] SN : 10542: Device Joined
[16:15:27.057 000 000] SN : 10542: Device connected
[16:19:39.887 000 000] SN : 10542: Session started: Port 1:"IO Meter Traffic"
[16:20:03.977 000 000] SN : 10542: Session stopped: Port 1:"IO Meter Traff
[16:28:55.795 000 000] SN : 10542: Session started: Ports 1:"IO Meter Traf
[16:31:04.024 000 000] SN : 10542: Session stopped: Ports 1:"IO Meter Traf
```

```
Port 1:   [16:30:22.208 187 000] Inject CRC Error: Value=16;
Port 2:   [16:30:22.263 931 000] Inject CRC Error: Value=0;
Port 3:   [16:30:22.309 455 000] Inject CRC Error: Value=0;
Port 4:   [16:30:22.347 685 000] Inject CRC Error: Valu
```

Figure 4.65: Copy Data from Log File Window

4.13 Scenario Batch Files

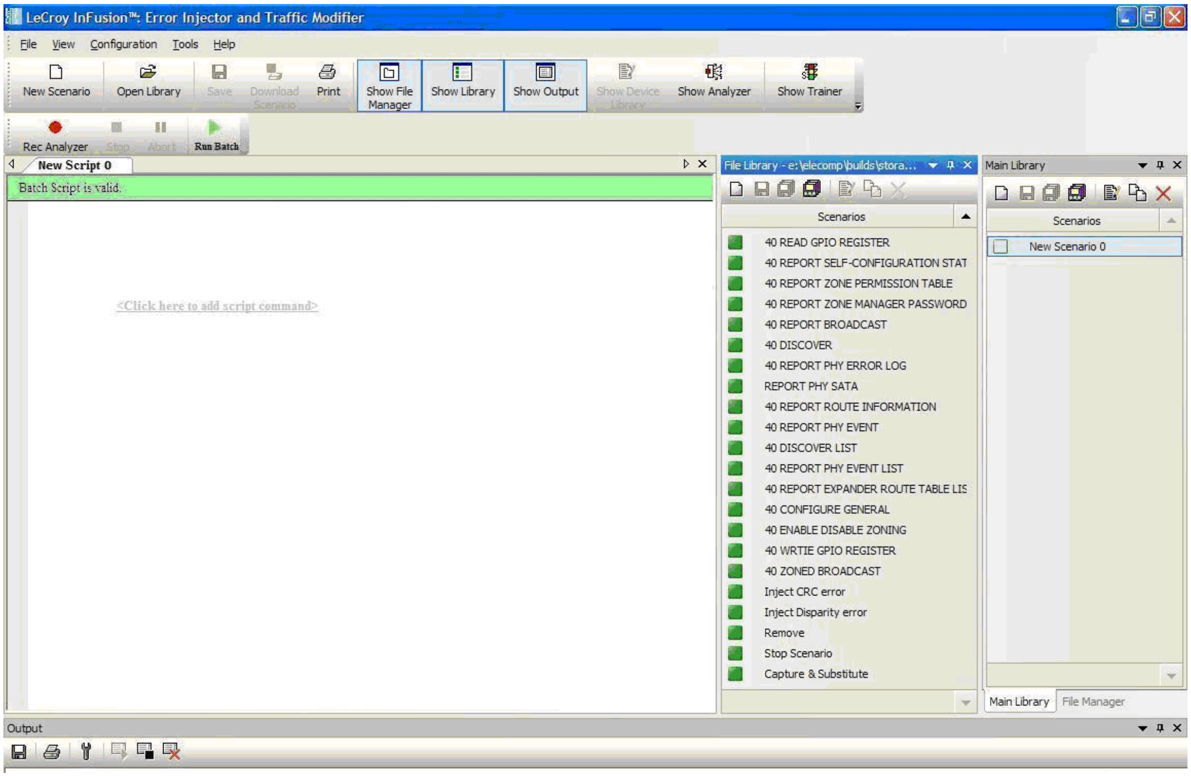
You can write a script with commands to run a sequence of executable scenarios automatically. A Scenario Batch file is a text file with a list of commands to run in sequence when you execute the file. A batch script can manage scenarios and their assigned ports and hardware in sequence, using conditions. The system checks for accuracy of inputs and commands.

Note: Before you run a Scenario Batch file that requests scenarios, you must download the scenarios to the Scenarios box.

To start a batch script, click the **New Batch Script** button or select **File > New Batch Script**.

4.13.1 Script Workspace

In the Script Workspace, add a command and make a batch file.


LeCroy InFusion™: Error Injector and Traffic Modifier
File View Configuration Tools Help
New Scenario
Open Library
Save
Download Scenario
Print
Show File Manager
Show Library
Show Output
Show Device Library
Show Analyzer
Show Trainer
Rec Analyzer
Stop
Abort
Run Batch
New Script 0
File Library - e:\elecomp\builds\stora...
Scenarios
40 READ GPIO REGISTER
40 REPORT SELF-CONFIGURATION STAT
40 REPORT ZONE PERMISSION TABLE
40 REPORT ZONE MANAGER PASSWORD
40 REPORT BROADCAST
40 DISCOVER
40 REPORT PHY ERROR LOG
REPORT PHY SATA
40 REPORT ROUTE INFORMATION
40 REPORT PHY EVENT
40 DISCOVER LIST
40 REPORT PHY EVENT LIST
40 REPORT EXPANDER ROUTE TABLE LIS
40 CONFIGURE GENERAL
40 ENABLE DISABLE ZONING
40 WRTIE GPIO REGISTER
40 ZONED BROADCAST
Inject CRC error
Inject Disparity error
Remove
Stop Scenario
Capture & Substitute
Main Library
Scenarios
New Scenario 0
Main Library
File Manager
Output

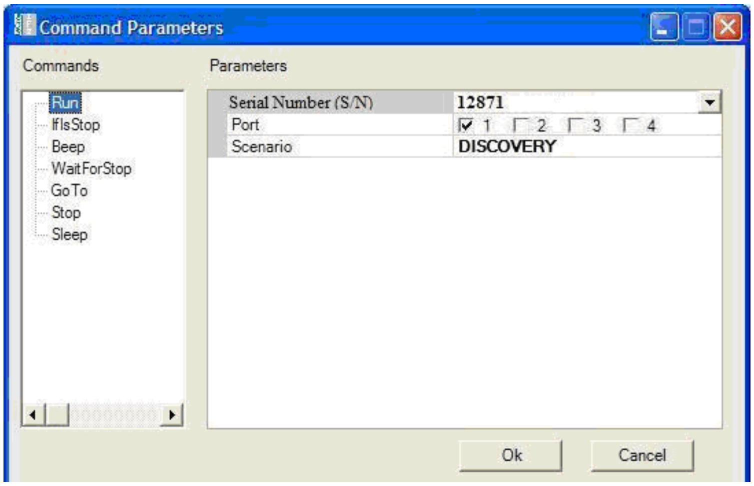
Batch Script is valid.

<Click here to add script command>

Figure 4.66: Script Workspace

In this window, you can enter a script command by clicking **Click here to add script command**.

3. First, click **Click here to add script command** to open the Command Properties dialog (see Figure 4.67 on page 348).

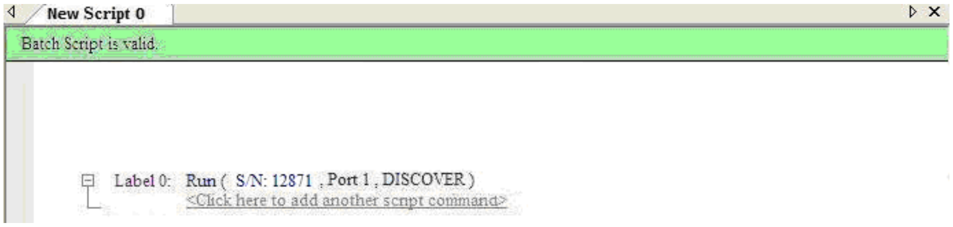


Serial Number (S/N)	12871
Port	☑ 1 ☐ 2 ☐ 3 ☐ 4
Scenario	DISCOVERY

Figure 4.67: Command Parameters Dialog

The Command Parameters Dialog contains the list of available commands and their parameters from which to build scenarios and connected hardware and available ports.

4. Select appropriate parameters for the command and click **OK** to display the script in the Script Workspace.



Batch Script is valid.

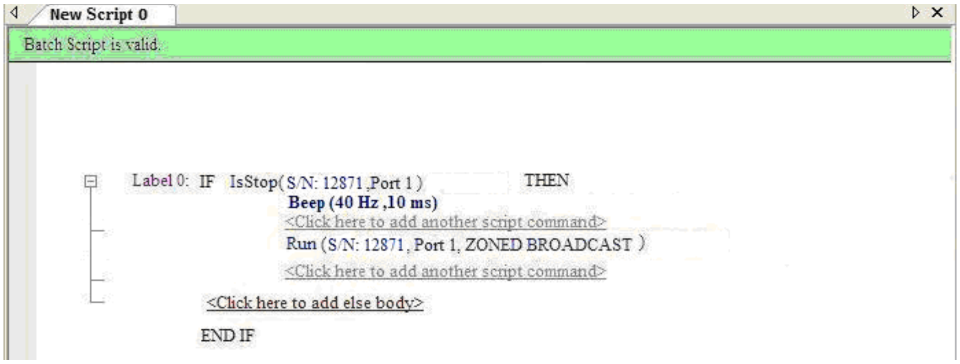
Label 0: Run (S/N: 12871 , Port 1 , DISCOVER)
<Click here to add another script command>

Note: You can select ports from the port list, depending on number of ports licensed.

Note: The hardware Serial Number can already exist or not. If the Serial Number exists, the Serial Number (for example, S/N: 12871) is shown. In Offline and Simulation mode, you can enter a Serial Number. In Online mode, you can only enter an existing Serial Number.

---

5. To add another command, click **Click here to add another script command.**



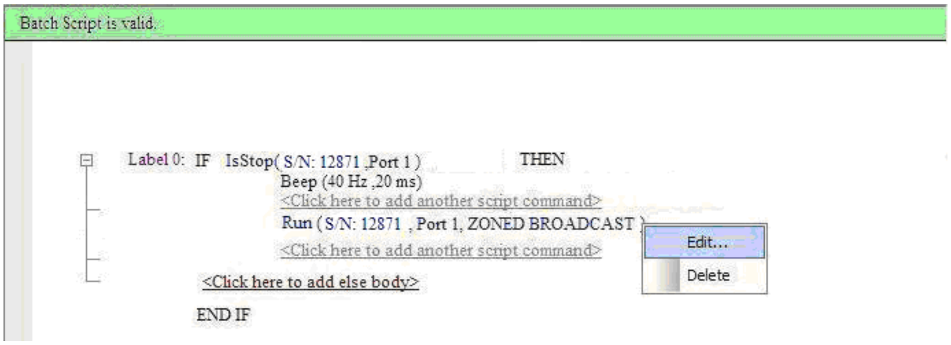
Batch Script is valid.

```
Label 0:  IF   IsStop( S/N: 12871 ,Port 1 )          THEN
                    Beep (40 Hz ,10 ms)
                    <Click here to add another script command>
                    Run ( S/N: 12871, Port 1, ZONED BROADCAST )
                    <Click here to add another script command>
          <Click here to add else body>
          END IF
```

To copy a script command, right-click on the command and select **Copy**.
Right-click **Click here to add another script command** and then select **Paste**.

You can also cut, delete, and edit a selected script command.

6. To edit batch commands, click the command, or right-click the command and select **Edit** from popup menu.

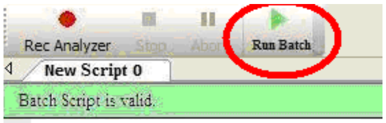


Batch Script is valid.

```
Label 0:  IF   IsStop( S/N: 12871 ,Port 1 )          THEN
                    Beep (40 Hz ,20 ms)
                    <Click here to add another script command>
                    Run ( S/N: 12871 , Port 1, ZONED BROADCAST )
                    <Click here to add another script command>
          <Click here to add else body>
          END IF
```

7. **To delete a command**, right-click and select **Delete** from popup menu, or select command and press **Delete** key on keyboard.

After finishing, if everything is correct, push the **Run Batch** button to execute scenario and save result in the log file.



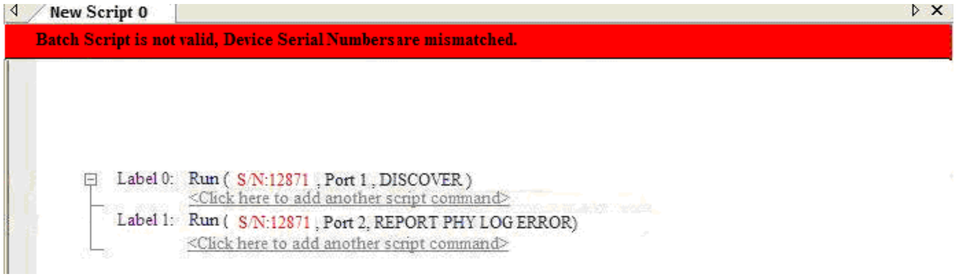
Batch Script is valid.

Note: Before you run a Scenario Batch file that requests scenarios, you must download the scenarios to the Scenarios box.

4.13.2 Error Checking

The Script Workspace shows errors by red color. The program reports all errors in the log file.

If you use a script from other InFusion hardware, it may cause an error, for example, mismatch in hardware Mac addresses, or scenarios that are not already in current hardware.



Batch Script is not valid, Device Serial Numbers are mismatched.

```
Label 0:  Run ( S/N:12871 , Port 1 , DISCOVER )
          <Click here to add another script command>
Label 1:  Run ( S/N:12871 , Port 2, REPORT PHY LOG ERROR)
          <Click here to add another script command>
```

4.13.3 Log

Results of executable batch commands are saved automatically into a log file with user-specified name. The status of executable commands is shown in log area.

4.13.4 Statements

Statements can be conditional statements or non-conditional statements.

IfIsStopped

Shows whether a scenario is already stopped or not.

Format

```
IfIsStopped (Serial Number, Target Port)
```

Parameters

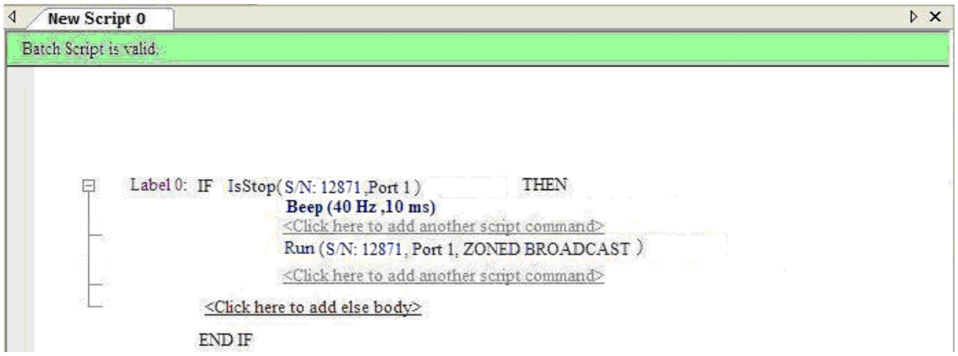
- **Serial Number**: Serial number of hardware
- **Target Port**: Port number in port map

Example

```
IfIsStopped(ox01267, 1) Then
  {
  Beep (750, 300)
  Run (ox01267," Detect AddressFrame Open", 5)
  }
```

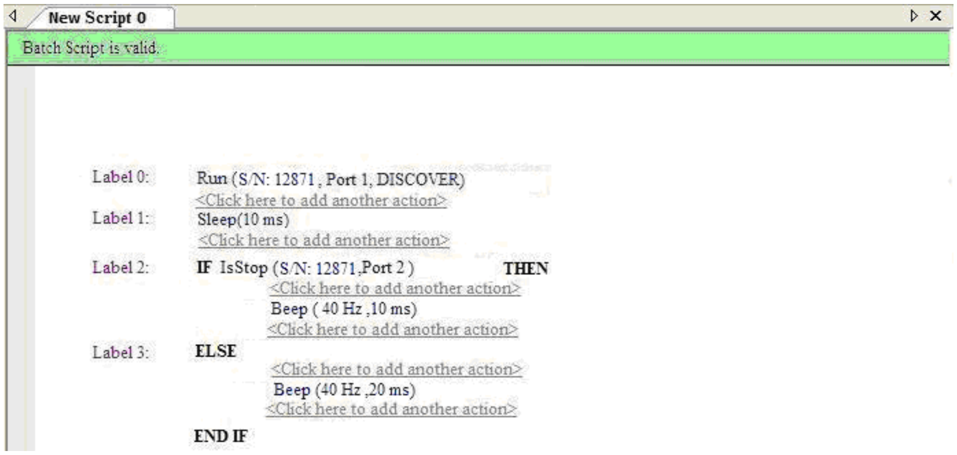
The value of second parameter is 5 and shows check stopping mode of combination of port number 1 and port number 3.

After filling parameters from the Command Parameters Dialog, the program makes the IF-ELSE structure in the Script workspace. The ELSE statement is optional. To add an ELSE body, click **Click here to add else body**.


New Script 0

Batch Script is valid.

```
Label 0:  IF  IsStop( S/N: 12871 ,Port 1 )           THEN
                   Beep (40 Hz ,10 ms)
                   <Click here to add another script command>
                   Run (S/N: 12871, Port 1, ZONED BROADCAST )
                   <Click here to add another script command>
          <Click here to add else body>
          END IF
```


New Script 0

Batch Script is valid.

```
Label 0:   Run (S/N: 12871 , Port 1, DISCOVER)
           <Click here to add another action>
Label 1:   Sleep(10 ms)
           <Click here to add another action>
Label 2:   IF IsStop (S/N: 12871,Port 2 )            THEN
                <Click here to add another action>
                Beep ( 40 Hz ,10 ms)
                <Click here to add another action>
Label 3:   ELSE
                <Click here to add another action>
                Beep (40 Hz ,20 ms)
                <Click here to add another action>
           END IF
```

Goto Label

Goes to specified label. Labels can be assigned to each script line.

Format

```
Goto Label3
```

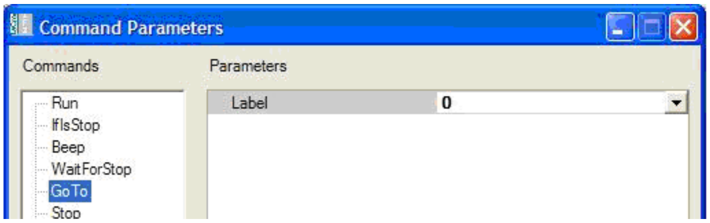
Parameters

none

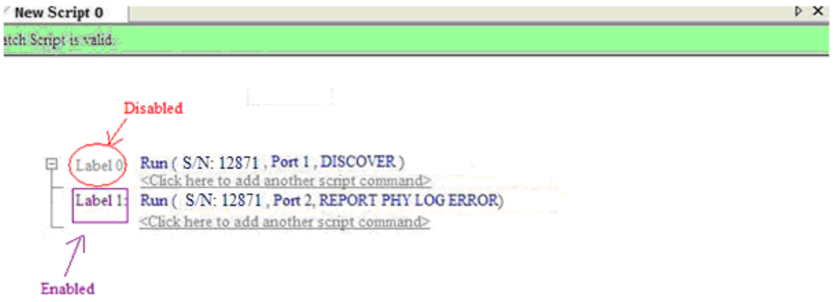
Example

```
Label3: WaitForStop(0x83456, 2, 100))
Run (ox01267," Inject CRC000", 4)
Goto Label7
```

Note: You can use a **Label** and a **Goto Label** to make loops. First make the label, then make Goto Label. The Command Parameters window shows only enabled Labels. Labels are disabled by default and are in gray color. To enable them, click them to make purple color.

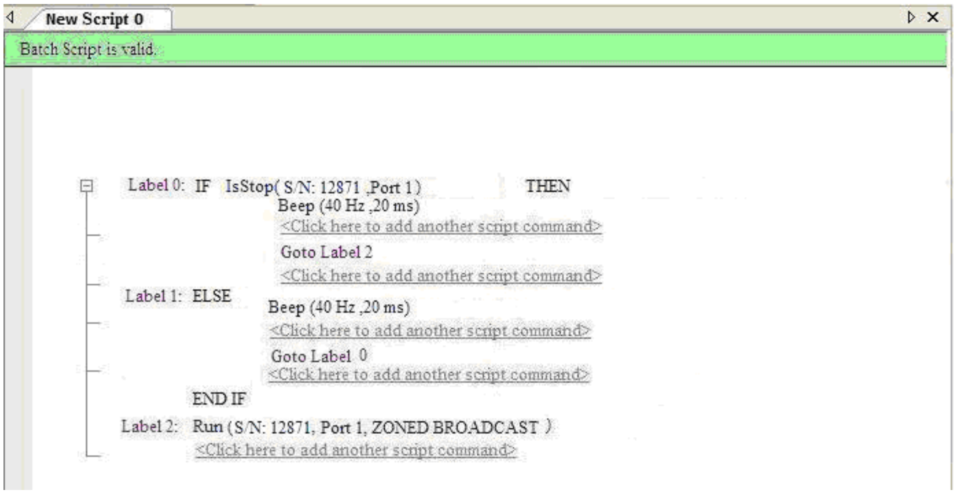

Command Parameters
Commands
Run
IfIsStop
Beep
WaitForStop
GoTo
Stop
Parameters

Label: 0



atch Script is valid.

```
Label 0  Run ( S/N: 12871 , Port 1 , DISCOVER )
         <Click here to add another script command>
Label 1: Run ( S/N: 12871 , Port 2, REPORT PHY LOG ERROR)
         <Click here to add another script command>
```



Batch Script is valid.

```
Label 0:  IF   IsStop( S/N: 12871 ,Port 1 )          THEN
                    Beep (40 Hz ,20 ms)
                     <Click here to add another script command>
                     Goto Label 2
                     <Click here to add another script command>
Label 1:  ELSE
                   Beep (40 Hz ,20 ms)
                    <Click here to add another script command>
                    Goto Label  0
                    <Click here to add another script command>
          END IF
Label 2:  Run (S/N: 12871, Port 1, ZONED BROADCAST )
          <Click here to add another script command>
```

Run

Runs the scenario on hardware on specified ports. If you call this command for the first time and the scenario was not assigned to the hardware and ports before, the scenario is assigned to specified hardware and ports and then scenario runs on the hardware.

Format

```
Run(Serial Number, Scenario Name, Target Port)
```

Parameters

- ❑ **Serial Number**: Serial number of hardware
- ❑ **Scenario Name**: Name of scenario
- ❑ **Target Port**: Port number in port map

Example

```
Run (ox841200," Substitute address frame", 4)
Beep(800, 400)
Run (ox841200," CRC Inject _ Play CD", 8)
WaitForStop(0x63463, 1, 150)
Run (ox841200," Remove Send Cue Sheet", 2)
Goto Label6
Run (S/N: 12871, Port 1, DISCOVER)
```

Note: If the selected ports are busy, scenario cannot run, and the command will be skipped. The result will be written in Log area.

Stop

Stops running scenario by hardware and port name.

Format

```
Stop (Serial Number, Target Port)
```

Parameters

- **Serial Number**: Serial number of hardware
- **Target Port**: Port number in port map

Example

```
Run (ox00820,"Inject CRC000", 2)
Beep(700, 500)
Stop (ox00820, 2)
Goto Label3
...
Label3 : Run(ox005007,"Detect DATA", 8)
Sleep(40)
```

WaitForStop

Used to wait for occurrence of specified condition.

Format

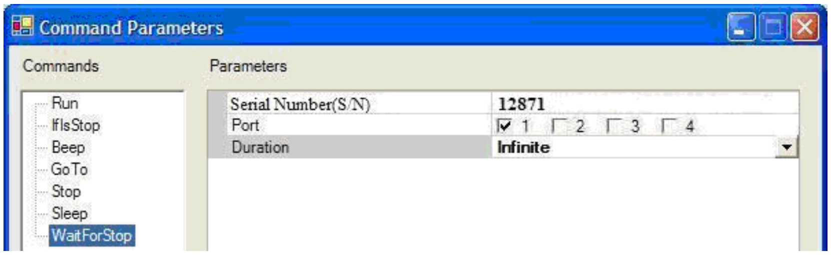
```
WaitForStop(SerialNumber, Target Port, Duration)
```

Parameters

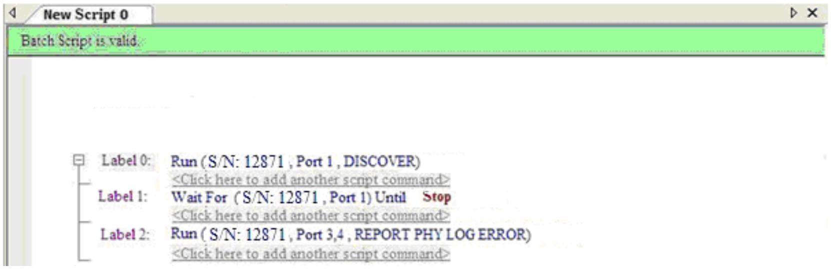
- **Serial Number**: Serial number of hardware
- **Target Port**: Port number in port map
- **Duration**: Integer or random duration in milliseconds. In the Command Parameters Window, WaitForStop duration has three options:
- **Infinite**: Wait until **Stop** command.
- **Random**: Stop after a random time.
- **Finite time**: Stop after specified time in milliseconds.

Example

```
Run (ox001267,"Detect AddressFrame Open", 2)
WaitForStop (0x348790, 2, Forever)
Run (ox005007,"Detect DATA", 4)
WaitForStop(ox005007, 4, 100)
Stop (ox001267, 2
```

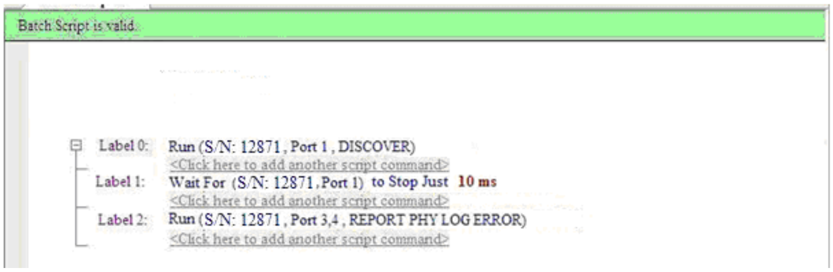


Serial Number(S/N)	12871
Port	☑ 1 ☐ 2 ☐ 3 ☐ 4
Duration	Infinite



Batch Script is valid.

```
Label 0:  Run (S/N: 12871 , Port 1 , DISCOVER)
          <Click here to add another script command>
Label 1:  Wait For  ( S/N: 12871 , Port 1) Until    Stop
          <Click here to add another script command>
Label 2:  Run ( S/N: 12871 , Port 3,4 , REPORT PHY LOG ERROR)
          <Click here to add another script command>
```



Batch Script is valid.

```
Label 0:  Run (S/N: 12871 , Port 1 , DISCOVER)
          <Click here to add another script command>
Label 1:  Wait For  (S/N: 12871 ,Port 1)  to Stop Just  10 ms
          <Click here to add another script command>
Label 2:  Run (S/N: 12871 , Port 3,4 , REPORT PHY LOG ERROR)
          <Click here to add another script command>
```

Sleep

Used to sleep for a few seconds.

Format

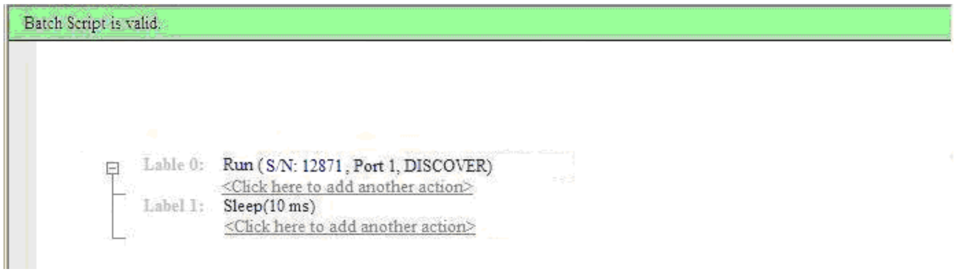
```
Sleep(Duration)
```

Parameters

- **Duration**: Integer or random duration in milliseconds

Example

```
Sleep(100)
```



Batch Script is valid.

```
Lable 0:  Run ( S/N: 12871 , Port 1, DISCOVER)
          <Click here to add another action>
Label 1:  Sleep(10 ms)
          <Click here to add another action>
```

Beep

If specified condition is satisfied, the system beep for specified duration.

Format

```
Beep (Duration, Frequency)
```

Parameters

- **Duration**: Integer or random duration in milliseconds
- **Frequency**: Frequency in hertz

Example

```
IfIsStopped(0x83456, 4)) then
  {
  Beep (2, 20)
  Run (0x83456,"Identify_Disparity error", 8)
  }
```

Chapter 5

Sierra Trainer Traffic Generation

The Sierra Trainer is a traffic generator that can emulate a SAS initiator/target or SATA host/device. Traffic generation enables engineers to test designs under realistic conditions and to transmit known errors, allowing engineers to observe how devices handle faulty link conditions.

Traffic generation is performed via the execution of text-based scripts. These traffic generation files (***.ssg**) contain statements about the types of traffic to be generated. These script files can be edited with either a simple text editor such as Notepad or with the Script Editor utility provided by the application.

To open the Traffic Generation window, click the **Launch Trainer Icon** Trainer in the SAS/SATA Protocol Suite window:

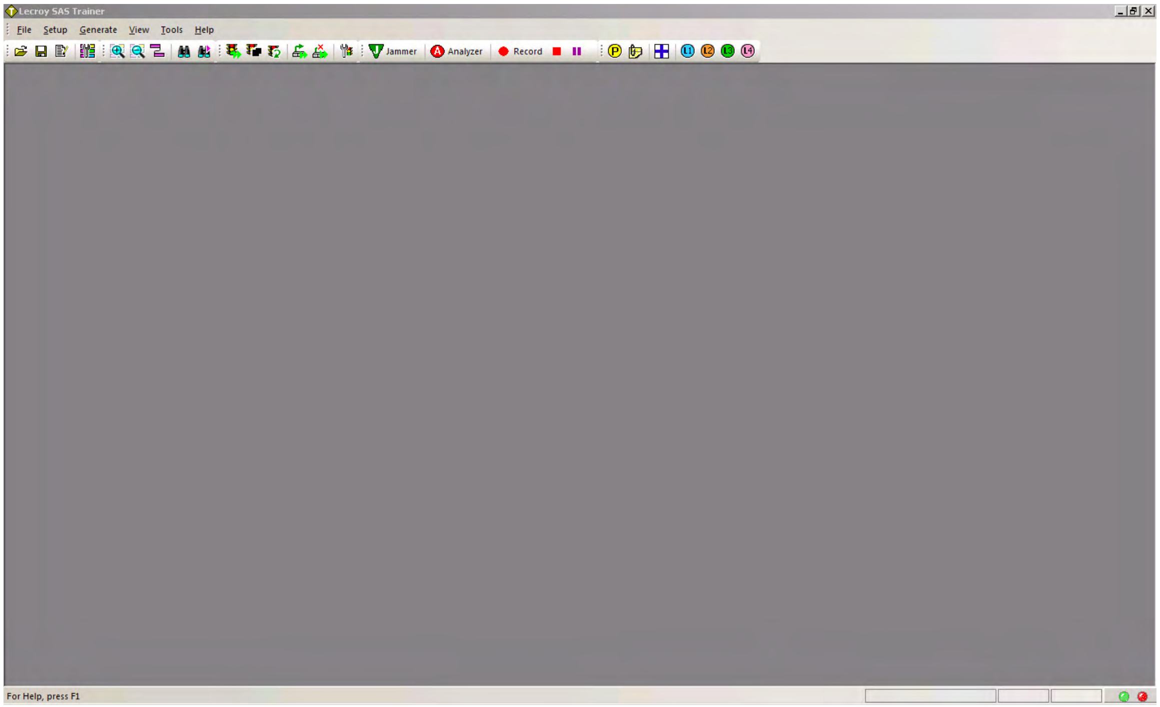


Figure 5.1: SAS: Sierra Trainer Window.

SATA: Replaces the SAS icon with the SATA icon for Show Analyzer Frame.

Note: Trainer has Power On and Power Off commands to control External Power Expansion Card.

5.1 Sierra Trainer Menus

The Sierra Trainer menus are:

5.1.1 File Menu

New GenFile: Starts a new Generation File.

Open: Opens a file.

Close: Closes the current window.

Launch Analyzer: Displays Analyzer Window.

Launch Analyzer: Displays Jammer (Infusion) Window.

Save As: Saves the current file with a new name.

Print: Prints part or all of the current traffic data file.

Print Preview: Produces an on-screen preview before printing.

Print Setup: Sets the options for the current or new printer.

Edit Comment: Allows you to enter a comment in a dialog.

Export: Saves trace as text file in Packet View Format.

Convert: Converts an SATrainer Generation File (**.stg** file) to a Generation File (**.ssg** file).

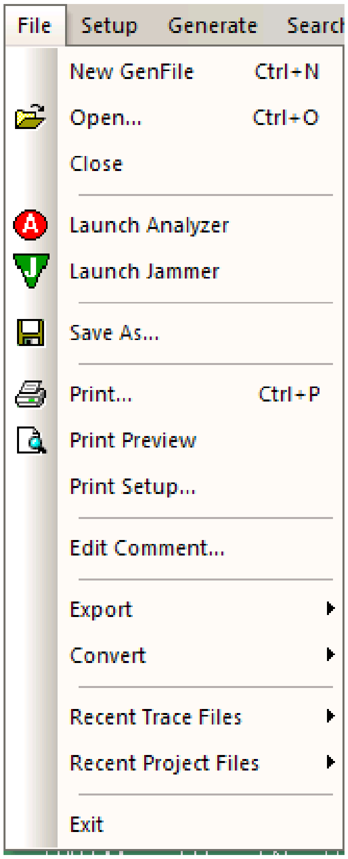

File
Setup
Generate
Searc
New GenFile Ctrl+N
Open... Ctrl+O
Close
Launch Analyzer
Launch Jammer
Save As...
Print... Ctrl+P
Print Preview
Print Setup...
Edit Comment...
Export
Convert
Recent Trace Files
Recent Project Files
Exit

Figure 5.2: Trainer File Menu.

5.1.2 Setup Menu

- ❑ **Update Sierra Device:** See “Update Device” on page 261.
- ❑ **Port Configuration**:

You can select different combinations of Trainer with Analyzer and Jammer. When running two different applications on the ports, you must set the same port configuration in both of them. See “Port Configuration” on page 108. The following describes possible configurations:

- **Analyzer and Trainer on same port**: You can generate initiator/target traffic and also capture the traffic generated.
- **Analyzer and Trainer on same port, and Analyzer and Trainer on another port**: You can generate initiator/target traffic and also capture the traffic generated on two ports.
- **Trainer on one port, Analyzer on another port, and Analyzer on a third port**: Trainer is run on a port generating initiator/target traffic and two port Analyzers run on two other ports capturing the traffic of those ports.
- **Trainer on two ports, and Analyzer on two ports**: Two Trainers run on two ports generating initiator/target traffic and two Analyzers run on two other ports capturing the traffic of those ports.
- **Trainer and Jammer on same port**: You can generate initiator/target traffic and also inject errors on the traffic between initiator and target on the port.

Note: See “Multi-Port Trainer Script Assignments to Links” on page 376.

Display Options: Selects what information to display. See “Display Options” on page 440.

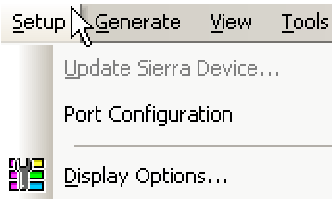


Figure 5.3: Trainer Setup Menu.

5.1.3 Generate Menu

Start Generation: Causes the Generator to begin generation.

Stop Generation: Causes the Generator to stop generation.

Resume Generation: Causes the Generator to resume generation after a stop.

Connect Link: Automatically bring the linkup to the Host, Device, Initiator, or Target connected to the Generator.

Disconnect Link: Disconnect link.

Connect Parameters: Set the “Identify” frame parameter settings to keep the link connected. See “Connection Parameters” on page 446.

Generation Options: Setup the Generation Rules. See “Auto Speed Negotiation” on page 427.

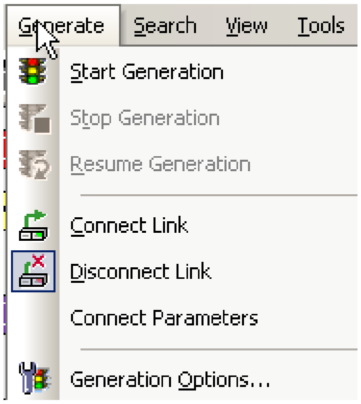
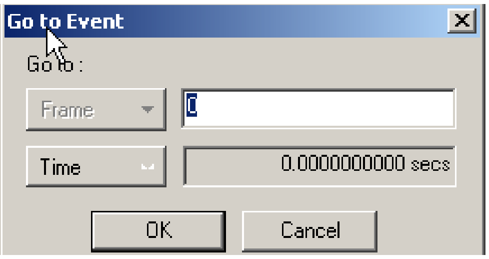

Generate
Search
View
Tools
Start Generation
Stop Generation
Resume Generation
Connect Link
Disconnect Link
Connect Parameters
Generation Options...

Figure 5.4: Trainer Generate Menu.

5.1.4 Search Menu

Go to Event: Opens a dialog that allows you to go to a frame and time.


Go to Event
Go to :
Frame
Time
OK
Cancel

0

0.0000000000 secs

Figure 5.5: Go to Event Dialog.

Go to Marker: Positions the display to the selected marked packet.

Go to: Packet Types, SSP Frames, SMP Frames, Primitives, Errors, Data Lengths, Speed, SATA FIS Type, SATA FIS Port, or Hash Address (Source or Destination). See Figure 5.6 on page 361.

Find: Displays the Find dialog. See “Find” on page 437.

Find Next: Applies the previous **Find** parameters to the next search.

Search Direction: Toggles the search forward or backwards. The current direction is indicated in the menu.

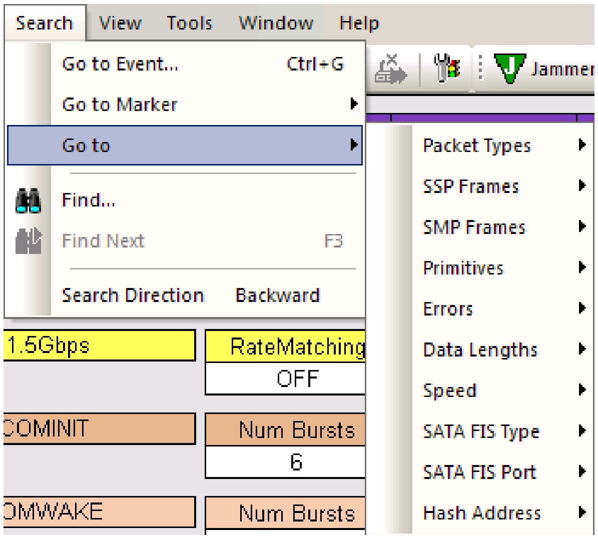

Search
View
Tools
Window
Help
Go to Event... Ctrl+G
Go to Marker
Go to
Find...
Find Next F3
Search Direction Backward
Jammer
Packet Types
SSP Frames
SMP Frames
Primitives
Errors
Data Lengths
Speed
SATA FIS Type
SATA FIS Port
Hash Address
1.5Gbps
RateMatching
OFF
COMINIT
Num Bursts
6
OMWAKE
Num Bursts

Figure 5.6: Trainer Search Menu.

5.1.5 View Menu

Zoom In: Increases the size of the displayed elements.

Zoom Out: Decreases the size of the displayed elements.

Toolbars: Displays list of available toolbars: Standard, Frequently Used, Generator, Analyzer, Ports, or Customize. See “Resetting the Toolbar” on page 447.

Status Bar: Toggles the Sierra Trainer Status Bar, at the bottom of the window, which shows help messages and the search direction. The right most segment displays the current search direction: Fwd (forward) or Bwd (backward). Change the search direction from the Search menu or double-click the Search Status segment.

Wrap: Wraps displayed packets within the window.

Compact: Displays each row on one line only, with no wrapping.

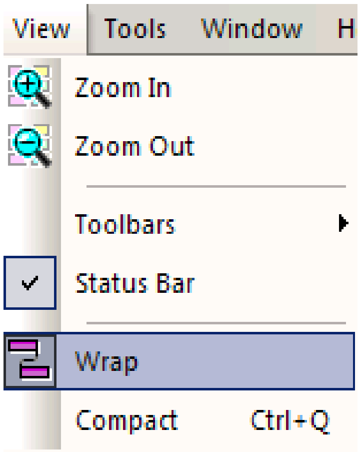
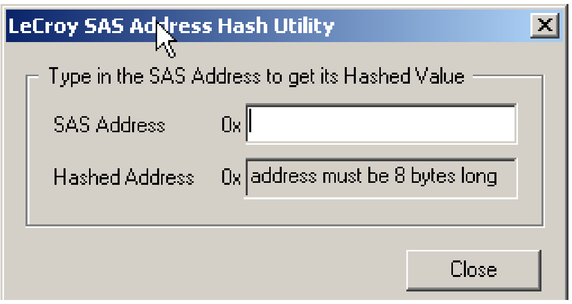

View
Tools
Window
H
Zoom In
Zoom Out
Toolbars
✓ Status Bar
Wrap
Compact Ctrl+Q

Figure 5.7: Trainer View Menu.

5.1.6 Tools Menu

Hash Address Utility: Opens a dialog that allows you to enter an eight-byte SAS Address to display a Hashed Address.


LeCroy SAS Address Hash Utility
Type in the SAS Address to get its Hashed Value
Close

SAS Address 0x

Hashed Address 0x address must be 8 bytes long

Figure 5.8: Address Hash Utility Dialog.

5.1.7 Window Menu

Cascade: Displays all open windows in an overlapping arrangement.

Tile Horizontal: Displays all open windows in a above-below arrangement.

Tile Vertical: Displays all open windows in a side-by-side arrangement.

Arrange Icons: Arranges minimized windows at the bottom of the display.

Windows: Displays a list of open windows.

5.1.8 Help Menu

Help Topics: Displays online help. You can also select F1.

Check for Updates: Check whether a new software version is available. If so, you can download from the Teledyne LeCroy web site. You can select to Check for updates at application startup.

About: Displays version information.

5.2 Sierra Trainer Main Toolbar

The Sierra Trainer toolbar contains the following buttons:

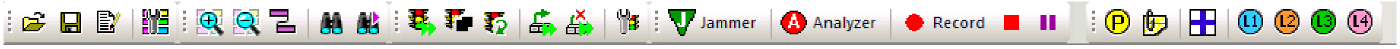


Figure 5.9: Sierra Trainer Toolbar.

The buttons have the following functions:

	Open Document.		Save As. Opens a dialog in which you can save your edits in the appropriate file type.
	Edit as Text. Edit the text file for the document.		Setup Display Options. Opens the Display Options window.
	Zoom In.		Zoom Out.

	Wrap.		Find.
	Find Next.		Start All Generation.
	Stop All Generation.		Resume All Generation.
	Connect All Link.		Disconnect All Link.
	Setup Generation Options. Opens the Generation Options window.	Jammer	Launch Jammer (Infusion).
Ⓐ Analyzer	Launch Analyzer.	● Record	Start Recording.
■	Stop Recording.	⏸	Abort Recording.
Ⓟ	Show Port Configuration Dialog. (See “Port Configuration” on page 108.)		Show Script Assignment Dialog. (See section below.)
⊞	Tile Windows	L1 L2 L3 L4	Assign Active Script/ Remove Assigned Script for Link 1, 2, 3, or 4 See “Multi-Port Trainer Script Assignments to Links” on page 376.

5.3 Setting Up for Generating Initiator Traffic

Connect the SAS cable from the **Target** port of the Sierra Analyzer to the Target port on the unit under test. This transmits the Traffic Generator stream from the **Target** port to the target-side port on the unit under test.

5.4 Setting Up for Generating Target Traffic

Connect the SAS cable from the **Initiator** port of the Sierra Analyzer to the Initiator-side port on the unit under test. This transmits the Traffic Generator stream from the **Initiator** port to the initiator-side port on the unit under test.

5.5 Creating a Traffic Generation File

Generating traffic is a two-step process.

First, create a text-based Sierra Trainer Traffic Generator file. This text file has an **.ssg** extension. You can create this file by creating a new generator file or editing an existing file.

Note: .ssg files created in other applications run in the Sierra Trainer.

After the file has been created, it can be opened and displayed in the application. You can invoke the application to transmit the traffic generation file by using the **Start Generation** button .

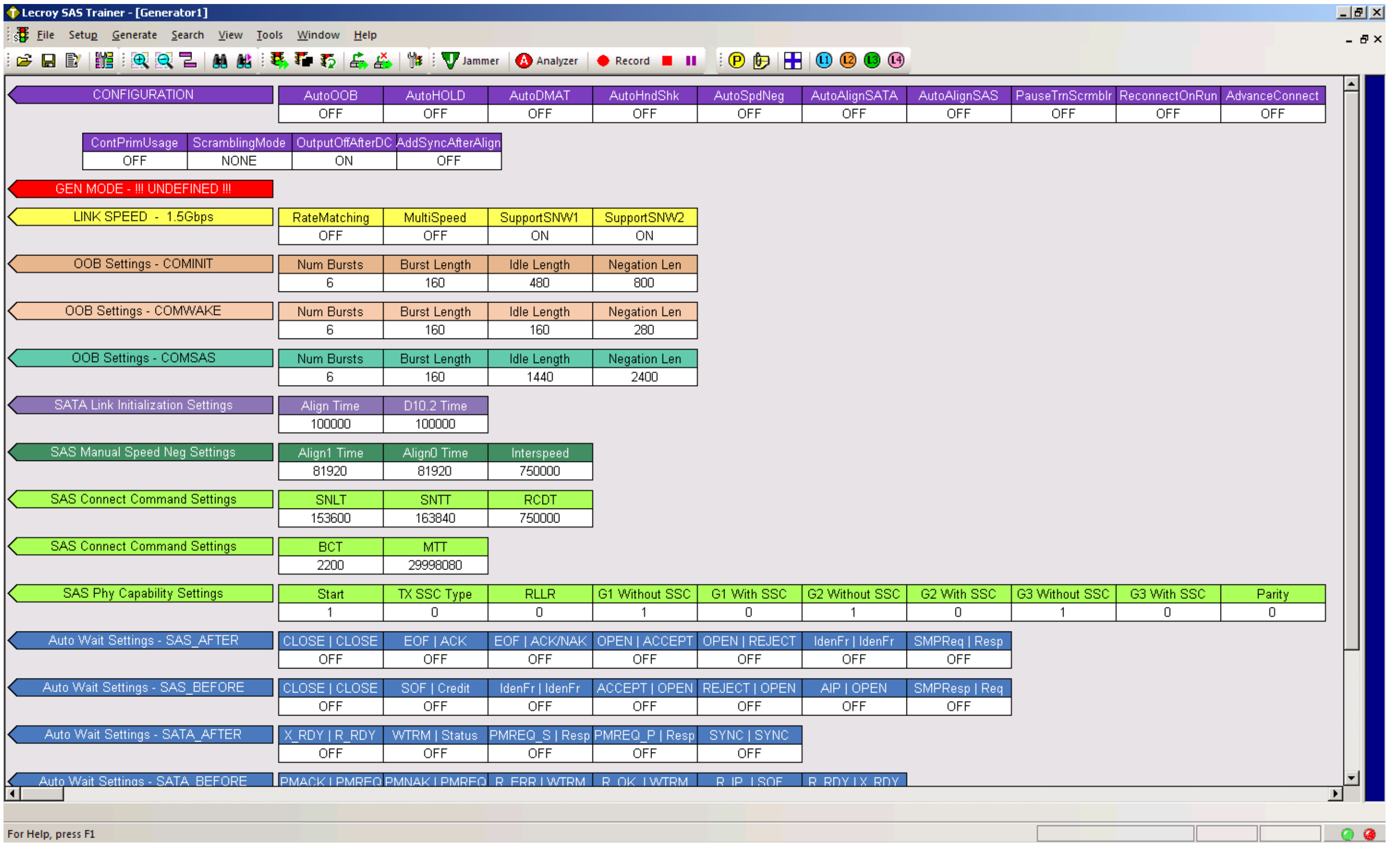
Note: For details about traffic generation files, see "Sierra Trainer Generation Language" on page 378.

5.5.1 Creating a New Generator File

You can create a new Sierra Trainer Traffic Generator **.ssg** file.

To create an **.ssg** file:

1. In the Sierra Trainer window, select **File > New GenFile** to display the Global Settings of a new **.ssg** file in a trace view.


Lecroy SAS Trainer - [Generator1]
File Setup Generate Search View Tools Window Help
Jammer Analyzer Record
For Help, press F1

CONFIGURATION

AutoOOB	AutoHOLD	AutoDMAT	AutoHndShk	AutoSpdNeg	AutoAlignSATA	AutoAlignSAS	PauseTrnScrmblr	ReconnectOnRun	AdvanceConnect
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

ContPrimUsage	ScramblingMode	OutputOffAfterDC	AddSyncAfterAlign
OFF	NONE	ON	OFF

GEN MODE - !!! UNDEFINED !!!

LINK SPEED - 1.5Gbps

RateMatching	MultiSpeed	SupportSNW1	SupportSNW2
OFF	OFF	ON	ON

OOB Settings - COMINIT

Num Bursts	Burst Length	Idle Length	Negation Len
6	160	480	800

OOB Settings - COMWAKE

Num Bursts	Burst Length	Idle Length	Negation Len
6	160	160	280

OOB Settings - COMSAS

Num Bursts	Burst Length	Idle Length	Negation Len
6	160	1440	2400

SATA Link Initialization Settings

Align Time	D10.2 Time
100000	100000

SAS Manual Speed Neg Settings

Align1 Time	Align0 Time	Interspeed
81920	81920	750000

SAS Connect Command Settings

SNLT	SNTT	RCDT
153600	163840	750000

SAS Connect Command Settings

BCT	MTT
2200	29998080

SAS Phy Capability Settings

Start	TX SSC Type	RLLR	G1 Without SSC	G1 With SSC	G2 Without SSC	G2 With SSC	G3 Without SSC	G3 With SSC	Parity
1	0	0	1	0	1	0	1	0	0

Auto Wait Settings - SAS_AFTER

CLOSE | CLOSE	EOF | ACK	EOF | ACK/NAK	OPEN | ACCEPT	OPEN | REJECT	IdenFr | IdenFr	SMPReq | Resp
OFF	OFF	OFF	OFF	OFF	OFF	OFF

Auto Wait Settings - SAS_BEFORE

CLOSE | CLOSE	SOF | Credit	IdenFr | IdenFr	ACCEPT | OPEN	REJECT | OPEN	AIP | OPEN	SMPResp | Req
OFF	OFF	OFF	OFF	OFF	OFF	OFF

Auto Wait Settings - SATA_AFTER

X_RDY | R_RDY	WTRM | Status	PMREQ_S | Resp	PMREQ_P | Resp	SYNC | SYNC
OFF	OFF	OFF	OFF	OFF

Auto Wait Settings - SATA_BEFORE

PMACK | PMREQ	PMNAK | PMREQ	R_ERR | WTRM	R_OK | WTRM	R_IP | SOF	R_RDY | X_RDY

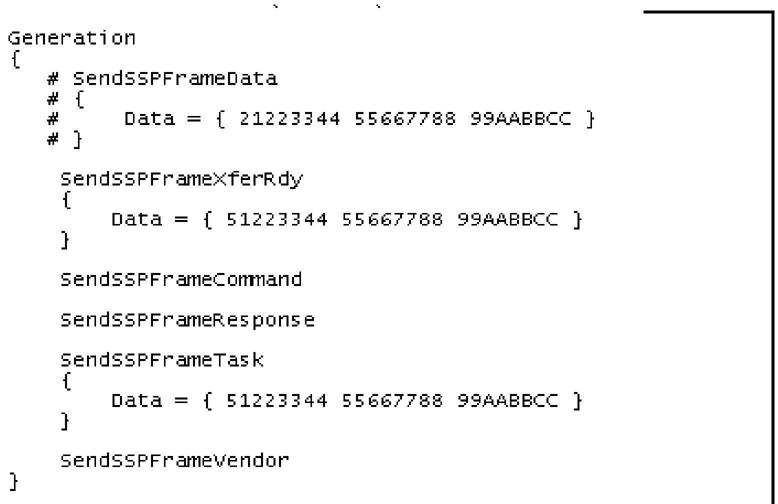
Figure 5.10: New GenFile.

2. Click the **Edit as Text** button to enter Generation Block or Change Settings instructions in the Generation Script Editor. See "Starting the Script Editor" on page 372.

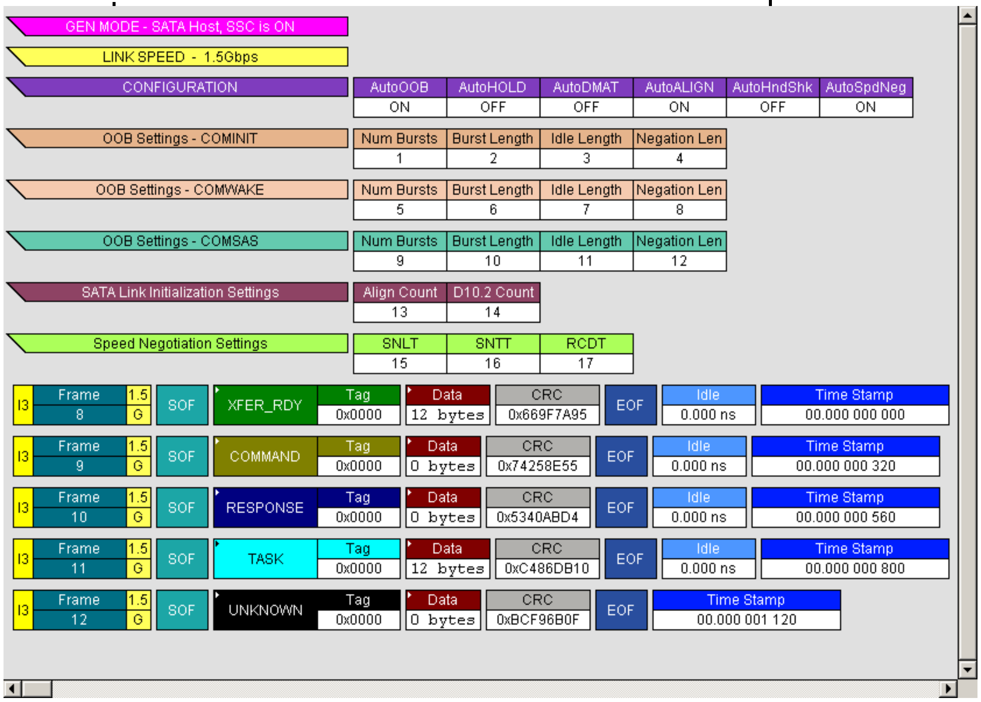
5.5.2 Editing an Example Generation File

The easiest way to generate traffic is to start with one of the example generation files and edit the settings to see how the script file behaves. As you make and save changes, the trace view of the generation file is automatically updated.

The following screen captures show an example file as it appears in the script editor and trace window.



```
Generation
{
   # SendSSPFrameData
   # {
   #     Data = { 21223344 55667788 99AABBCC }
   # }

    SendSSPFrameXferRdy
    {
        Data = { 51223344 55667788 99AABBCC }
    }

    SendSSPFrameCommand

    SendSSPFrameResponse

    SendSSPFrameTask
    {
        Data = { 51223344 55667788 99AABBCC }
    }

    SendSSPFrameVendor
}
```



GEN MODE - SATA Host, SSC is ON

LINK SPEED - 1.5Gbps

CONFIGURATION

AutoOOB	AutoHOLD	AutoDMAT	AutoALIGN	AutoHndShk	AutoSpdNeg
ON	OFF	OFF	ON	OFF	ON

OOB Settings - COMINIT

Num Bursts	Burst Length	Idle Length	Negation Len
1	2	3	4

OOB Settings - COMWAKE

Num Bursts	Burst Length	Idle Length	Negation Len
5	6	7	8

OOB Settings - COMSAS

Num Bursts	Burst Length	Idle Length	Negation Len
9	10	11	12

SATA Link Initialization Settings

Align Count	D10.2 Count
13	14

Speed Negotiation Settings

SNLT	SNTT	RCDT
15	16	17

	Frame	1.5 G			Tag	Data	CRC		Idle	Time Stamp
I3	8	1.5 G	SOF	XFER_RDY	0x0000	12 bytes	0x669F7A95	EOF	0.000 ns	00.000 000 000
I3	9	1.5 G	SOF	COMMAND	0x0000	0 bytes	0x74258E55	EOF	0.000 ns	00.000 000 320
I3	10	1.5 G	SOF	RESPONSE	0x0000	0 bytes	0x5340ABD4	EOF	0.000 ns	00.000 000 560
I3	11	1.5 G	SOF	TASK	0x0000	12 bytes	0xC486DB10	EOF	0.000 ns	00.000 000 800
I3	12	1.5 G	SOF	UNKNOWN	0x0000	0 bytes	0xBCF96B0F	EOF		00.000 001 120

In the screen capture, global settings make up the eight bars at the top of the window. Below that are five frames. If you look at the script itself, there are six frame commands, five active and one commented out.

The following sections describe how to open and edit traffic generation files.

5.5.3 Converting an SATrainer Traffic Generation File

If you have old 2500-based SATrainer Generator **.stg** files, you can convert them to Sierra Trainer Traffic Generator **.ssg** files using the legacy **Convert** function.

To convert an **.stg** file into an **.ssg** file:

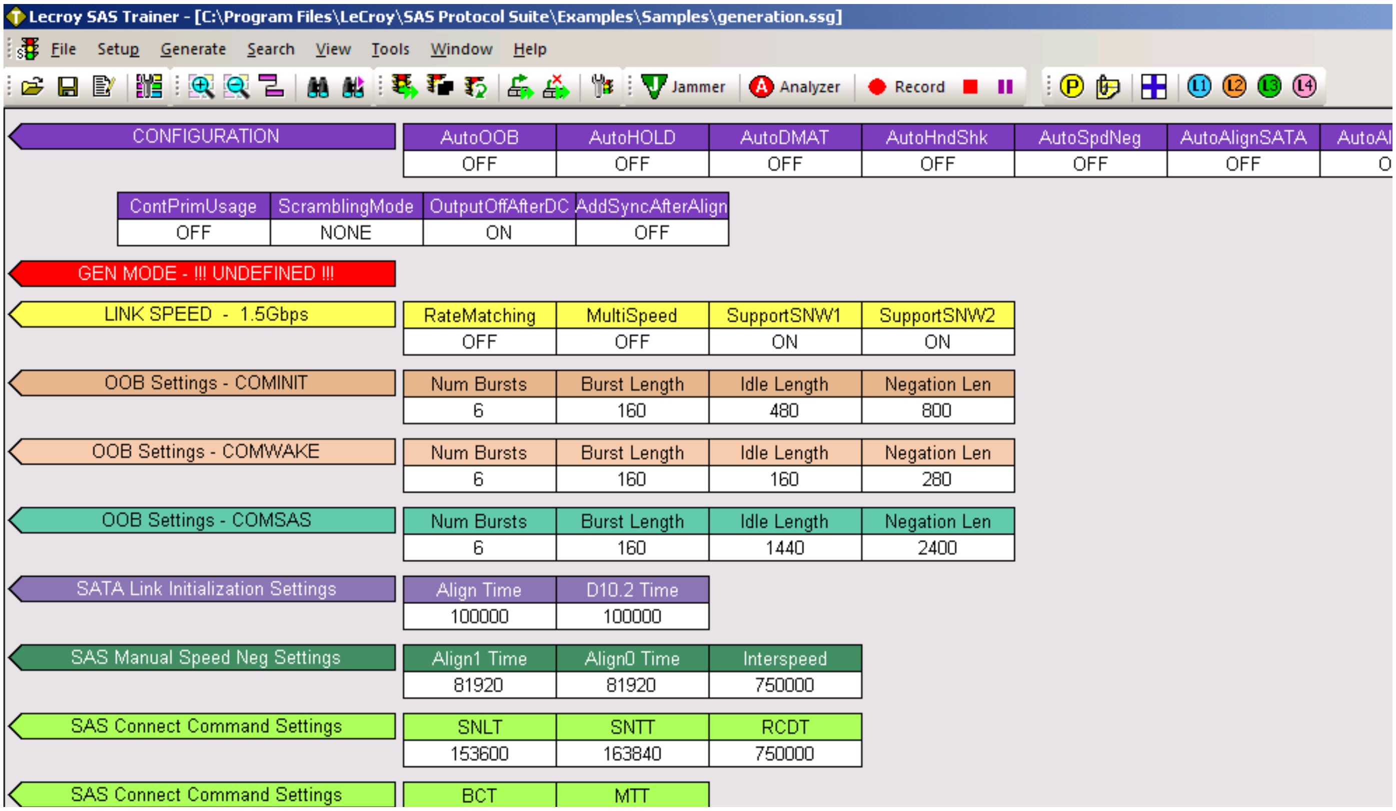
1. In the Sierra Trainer window, select **File > Convert > Convert .stg to .ssg** to display an Open dialog.
2. Use Files of Type **SATrainer Generator Files (.stg).**
3. Select an SATrainer Generator ***.stg** file.
4. Click **Open**. The application creates a Sierra Trainer Traffic Generator file (***.ssg**).

5.5.4 Opening a Traffic Generation File

After the Traffic Generator file (***.ssg)** file has been created, you can open it in the application.

To open a Traffic Generator file:

1. Select **File > Open** on the Menu Bar, or click on the Toolbar, to display an Open dialog.
2. Select a Generator text file (***.ssg**) and click **Open** to display the file (see Figure 5.11 on page 366). (The install directory contains example files.)


Lecroy SAS Trainer - [C:\Program Files\LeCroy\SAS Protocol Suite\Examples\Samples\generation.ssg]
File
Setup
Generate
Search
View
Tools
Window
Help
Jammer
Analyzer
Record

CONFIGURATION

AutoOOB	AutoHOLD	AutoDMAT	AutoHndShk	AutoSpdNeg	AutoAlignSATA	AutoAl
OFF	OFF	OFF	OFF	OFF	OFF	O

ContPrimUsage	ScramblingMode	OutputOffAfterDC	AddSyncAfterAlign
OFF	NONE	ON	OFF

GEN MODE - !!! UNDEFINED !!!

LINK SPEED - 1.5Gbps

RateMatching	MultiSpeed	SupportSNW1	SupportSNW2
OFF	OFF	ON	ON

OOB Settings - COMINIT

Num Bursts	Burst Length	Idle Length	Negation Len
6	160	480	800

OOB Settings - COMWAKE

Num Bursts	Burst Length	Idle Length	Negation Len
6	160	160	280

OOB Settings - COMSAS

Num Bursts	Burst Length	Idle Length	Negation Len
6	160	1440	2400

SATA Link Initialization Settings

Align Time	D10.2 Time
100000	100000

SAS Manual Speed Neg Settings

Align1 Time	Align0 Time	Interspeed
81920	81920	750000

SAS Connect Command Settings

SNLT	SNTT	RCDT
153600	163840	750000

SAS Connect Command Settings

BCT	MTT

Figure 5.11: Sierra Trainer Generator File.

5.5.5 Layout

The **.ssg** file has several colored bars that represent global settings. The bars show the current configuration of the generation file. Example settings are:

- Configuration
- GenMode (SAS or SATA, SSC On or Off)
- Link speed (1.5 Gbps, 3.0 Gbps, 6.0 Gbps or 12.0 Gbps)
- Type of device (Initiator or Device)
- COMINIT
- COMWAKE
- Scrambling Mode

As changes are made and saved to the traffic generation file, the bars immediately update. The traffic pattern to generate appears below the bars as a series of frames. You can edit the traffic generation file to add, edit or remove frames.

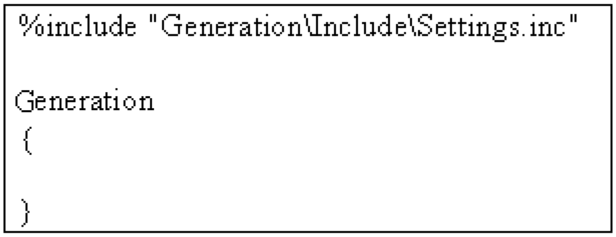
5.6 Overview of Generation and Global Settings Files

Example **.ssg** files and **Include** files are in two directories called **\Samples** and **\Include** that are typically installed in: **C:\Users\Public\Documents\LeCroy\SAS SATA Protocol Suite\Generation\Samples**.

5.6.1 Traffic Generation (*.ssg) Files

The .**ssg** traffic generation files are text files consisting of **include** statements, a generation block, and optionally global statements.

The generation block is the code responsible for the actual traffic generation. It is marked by the tag **Generation**. The composition and format of the generation block is described later.



```
%include "Generation\Include\Settings.inc"

Generation
{

}
```

The **include** statements provide links to the **Include** files, which provide the definitions for primitives, frames, and settings that hold for most or all of the generation session (global settings).

The definitions for SAS and SATA traffic are contained in Teledyne LeCroy-provided **Include** files: Settings.inc, PrimitivesDecl.inc, AddressFramesDecl.inc, SSPFrames.inc, SMPFrames.inc, and SSPFrames.inc.

5.6.2 SasSettings.inc File

The **SasSettings.inc** file contains global statements about the link, the type of device being emulated, and other conditions that are to exist throughout part or all of the traffic generation. This file must be included in the traffic generation file.

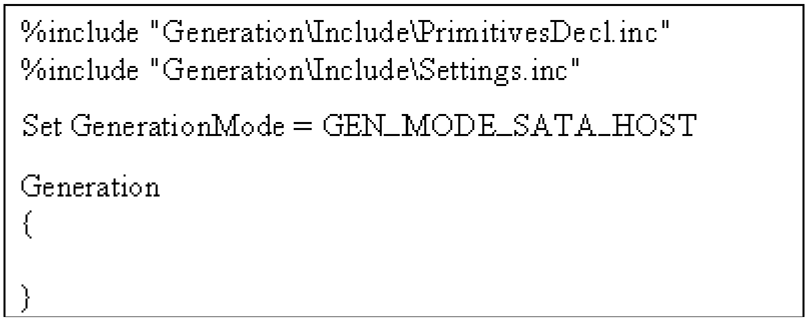
There are fifteen groups of settings in this file:

- AutoMode
- COMINIT/COMRESET OOB Signal
- COMWAKE OOB Signal
- COMSAS OOB Signal
- Generation Commands
- Link Speed
- SATA Link Initialization
- SAS Speed Negotiation
- SATA Speed Negotiation
- Autowait:
  - SAS After
  - SAS Before
  - SATA After
  - SATA Before
- Wait Command Timeout
- Scrambling Mode

Details about each group of settings are described in the **Traffic Generation Language** section.

Editing Settings.inc

Text in the **Settings.inc** file can be edited directly or copied into the beginning of the traffic generation file and edited there.

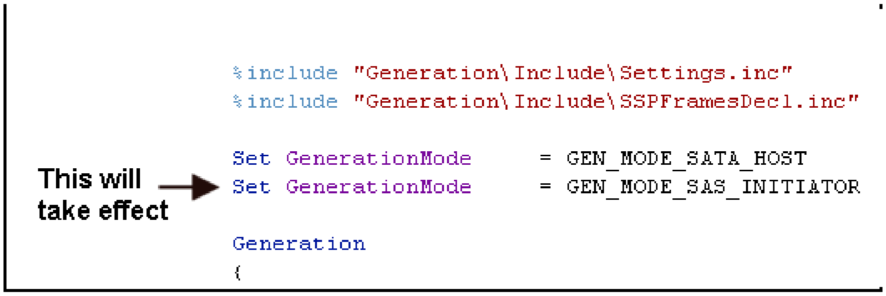


```
%include "Generation\Include\PrimitivesDecl.inc"
%include "Generation\Include\Settings.inc"

Set GenerationMode = GEN_MODE_SATA_HOST

Generation
{

}
```

When editing global settings, keep in mind the following rule: The last line encountered before the generation block takes precedence. Thus, if the following two lines about the device emulation were added just above the generation block, the second would take effect:

set GenerationMode = GEN_MODE_SATA_HOST

set GenerationMode = GEN_MODE_SAS_INITIATOR



```
%include "Generation\Include\Settings.inc"
%include "Generation\Include\SSPFramesDecl.inc"

Set GenerationMode      = GEN_MODE_SATA_HOST
Set GenerationMode      = GEN_MODE_SAS_INITIATOR

Generation
{
```

This will take effect

The Global Setting “AutoAlign”

AutoAlign is a global setting that may be on or off depending on the type of device you are emulating. There is an AutoAlign setting for SAS and one for SATA, for example, “set AutoAlignSAS = ON” and “set AutoAlignSATA=OFF.”

- SAS: Sends AutoAligns every 2048 DWORDs.
- SATA: Sends AutoAligns every 256 DWORDs.

If you plan to set and reset AutoAlign in the middle of traffic generation, you need to know what the defaults are for AutoAlign. The defaults are as follows:

For SATA host/device emulation,:

- AutoAlignSATA is assumed to be ON.
- AutoAlignSAS is assumed to be OFF.

For SAS emulation, the assumptions are opposite:

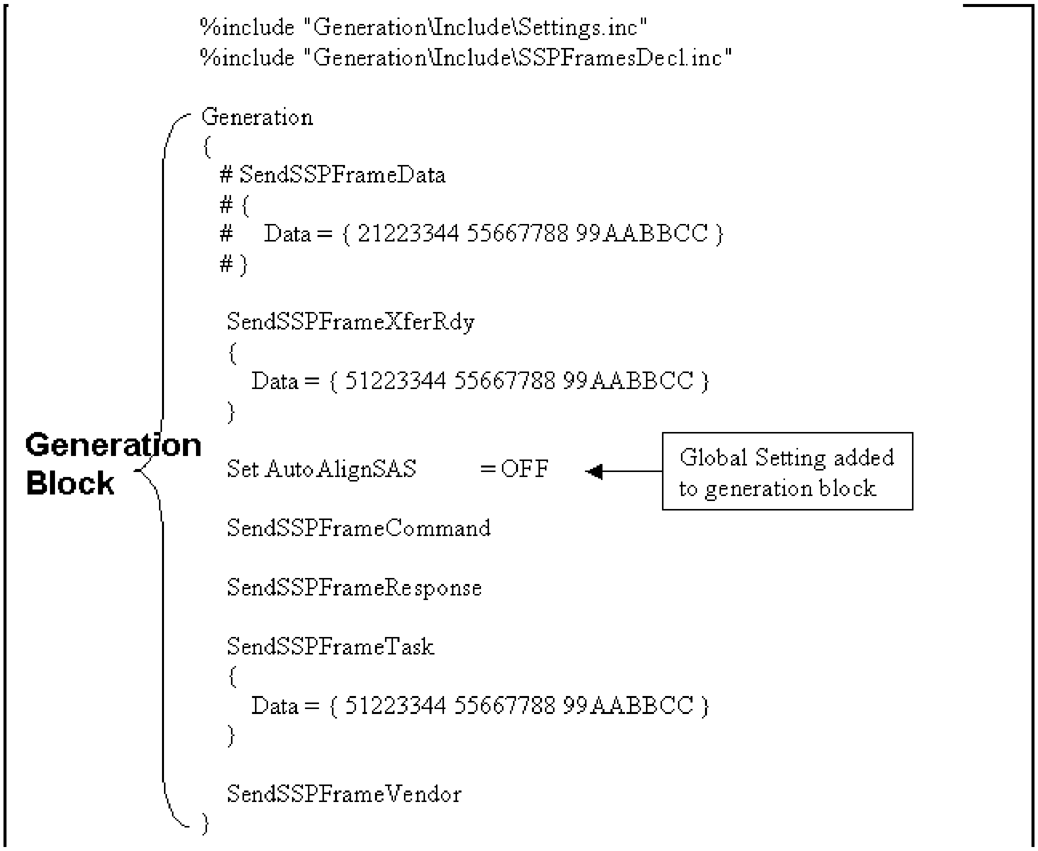
- AutoAlignSATA is assumed to be OFF.
- AutoAlignSAS is assumed to be ON.

For STP:

- AutoAlignSAS and AutoAlignSATA are assumed to be ON.

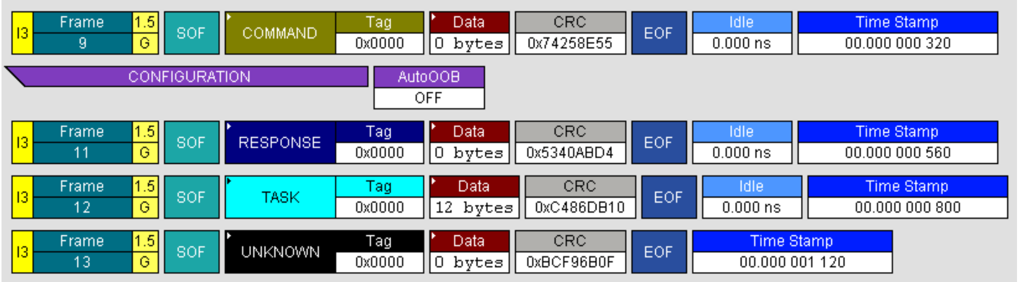
Placing Global Settings in the Generation Block

Some global settings such as AutoAlign = On/Off can be set and reset in the generation block. For example, you might want to set SASAutoAlign = ON prior to traffic generation, and then change to OFF halfway through the generation session.



```
%include "Generation\Include\Settings.inc"
%include "Generation\Include\SSPFramesDecl.inc"

Generation
{
  # SendSSPFrameData
  # {
  #    Data = { 21223344 55667788 99AABBCC }
  # }

   SendSSPFrameXferRdy
   {
      Data = { 51223344 55667788 99AABBCC }
   }

   Set AutoAlignSAS        = OFF

   SendSSPFrameCommand

   SendSSPFrameResponse

   SendSSPFrameTask
   {
      Data = { 51223344 55667788 99AABBCC }
   }

   SendSSPFrameVendor
}
```

When placed within the generation block and then viewed in the trace window, global settings appear as colored bars interspersed amidst the traffic.



I3	Frame 9	1.5 G	SOF	COMMAND	Tag 0x0000	Data 0 bytes	CRC 0x74258E55	EOF	Idle 0.000 ns	Time Stamp 00.000 000 320
CONFIGURATION	AutoOOB OFF									
I3	Frame 11	1.5 G	SOF	RESPONSE	Tag 0x0000	Data 0 bytes	CRC 0x5340ABD4	EOF	Idle 0.000 ns	Time Stamp 00.000 000 560
I3	Frame 12	1.5 G	SOF	TASK	Tag 0x0000	Data 12 bytes	CRC 0xC486DB10	EOF	Idle 0.000 ns	Time Stamp 00.000 000 800
I3	Frame 13	1.5 G	SOF	UNKNOWN	Tag 0x0000	Data 0 bytes	CRC 0xBCF96B0F	EOF	Time Stamp 00.000 001 120	

While most global settings can be set in the generation block, three will be ignored if placed within the generation block:
set Link Speed =
set GenerationMode =
set SSC =

These commands should be configured either in the **Setting.inc** file or at the beginning of the traffic generation file as a global statement.

5.7 Primitive and Frame Definitions

Five other **Include** files are provided that define the most of the known templates for Primitives and Frames. The five are:

- PrimitivesDecl.inc

- ❑ AddressFramesDecl.inc
- ❑ SSPFramesDecl.inc
- ❑ SMPFramesDecl.inc
- ❑ STPFramesDecl.inc

Each of the Frame templates defines header and field structure.

The default value for all Frame fields is zero.

5.7.1 Special Conditions for Frames

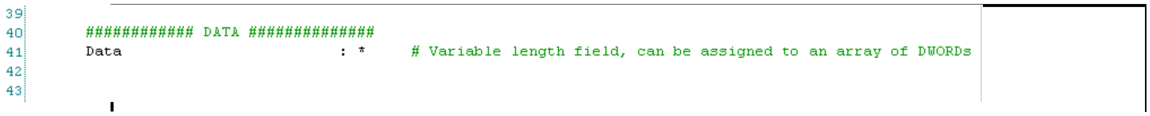
There are three conditions about Frames that need to be kept in mind when configuring Frame generation:

1. Frame delimiters need to agree - At the present time, when defining a Frame, make sure that the Frame Prologue and Frame Epilogue agree. Do not mix types. For example, do not mix a SAS Start of Frame (SOF) with a SAS End of Address Frame (EOAF).

A SAS SOF should be matched to a SAS EOF. A SAS SOAF should be matched to a SAS EOAF. If generating SATA traffic, a SATA_SOF should be matched to a SATA_EOF.

At the present time, if you mix different types of prologues and epilogues for any given Frame, the Frame is ignored.

2. Data Length Fields can be fixed-length or variable - By default, data frames are of a fixed length. If you want to generate variable length frames, place an asterisk in the Data definition field in the **SSPFramesDecl.inc** file:
Data : *



```

############ DATA ##############
Data                       : *     # Variable length field, can be assigned to an array of DWORDs


```

If you replace the asterisk with a value, then the field becomes fixed length.

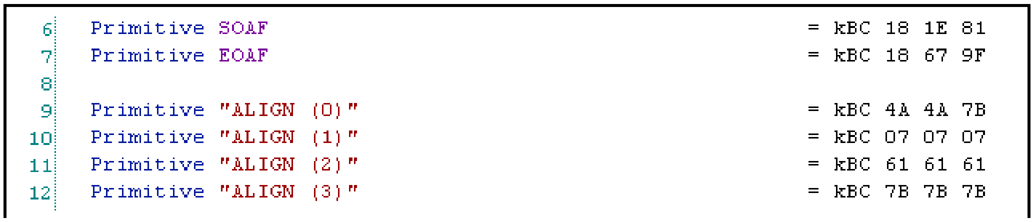
3. CRC Calculations are calculated unless told otherwise - If the CRC is not explicitly set in the traffic generation file, the application assumes that you want it and calculates and displays it in front of the generated frames.

If you provide a CRC value, the application uses that value, even if it is incorrect. This gives you the option of configuring the generator to create errors.

If the generation file was created through the Export command (File > Export > To Generator File Format ...), the CRC is calculated but commented out. If the source trace has a bad CRC, the CRC is exported into the generation file and is not commented out.

5.7.2 Primitives Decl.inc File

The **PrimitivesDecl**.inc file defines Primitives. The file consists of declarations (left) and the corresponding byte streams (right).



```
Primitive SOAF                                  = kBC 18 1E 81
Primitive EOAF                                  = kBC 18 67 9F

Primitive "ALIGN (0)"                           = kBC 4A 4A 7B
Primitive "ALIGN (1)"                           = kBC 07 07 07
Primitive "ALIGN (2)"                           = kBC 61 61 61
Primitive "ALIGN (3)"                           = kBC 7B 7B 7B
```

To generate Primitives, copy relevant portions of text on the left (not the bytes shown right) from this file into the generator block section of the **.ssg** file.

5.7.3 Address FramesDecl.inc File

The **AddressFramesDecl**.inc file defines Address frames.

5.7.4 SSPFrames.inc File

The **SSPFrames.inc** file defines SSP frames.

5.7.5 SMPFrames.inc File

The **SMPFrames.inc** file defines SMP frames.

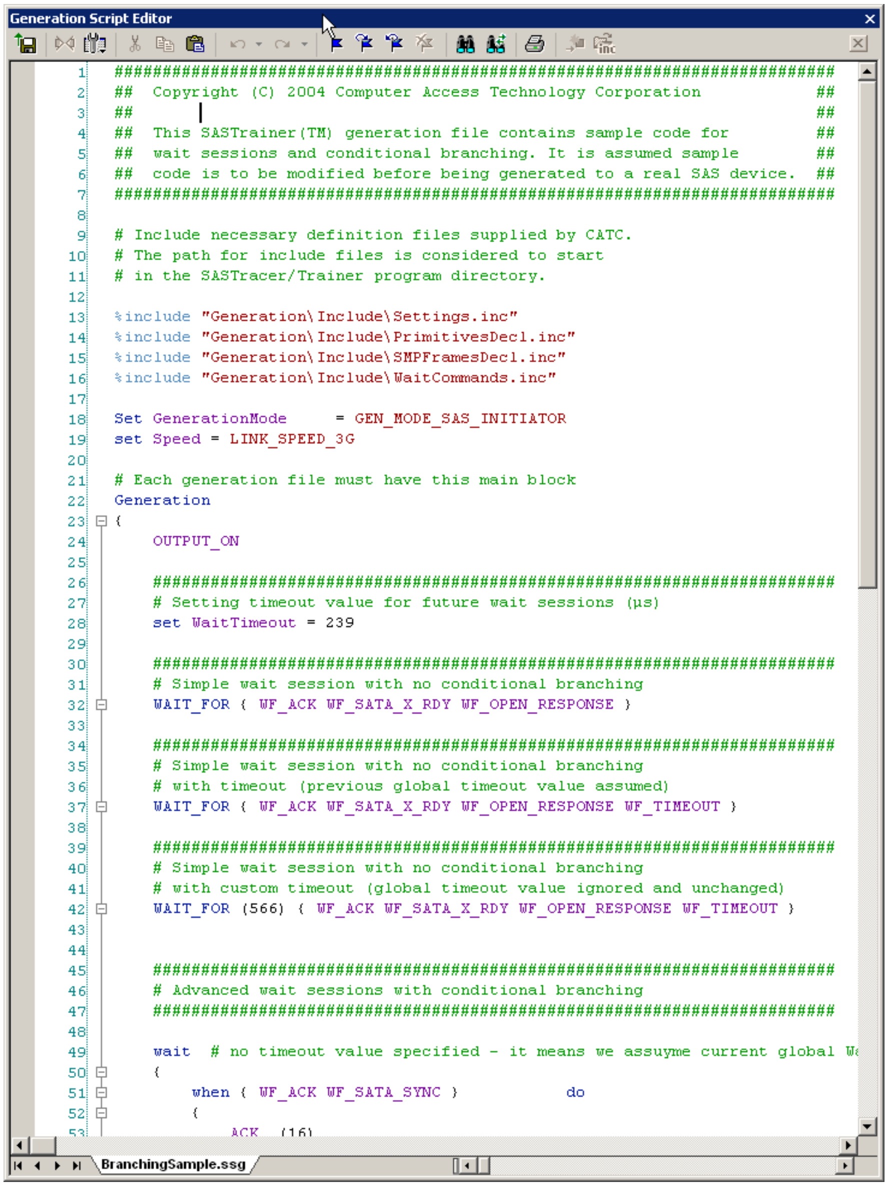
5.7.6 STPFrames.inc File

The **STPFrames.inc** file defines STP frames.

5.8 Starting the Script Editor

To edit an **.ssg** file, use the Script Editor. The Script Edit editing tool displays the **.ssg** file and its supporting **Include** files. The Script Editor utility has several aids to simplify the process of writing and editing scripts: tool-tips, drop-down menus, and colored fields. The Script Editor example below shows several commented lines followed by some instructions. The Script Editor has three areas: toolbar (top), script window, and file tabs (at the bottom of the window). If errors occur, a log opens at the bottom of the window. **Note**: If more than one port of Trainer is licensed, you can assign scripts to one or more ports. See “Multi-Port Trainer Script Assignments to Links” on page 376.

To launch the Script Editor, click the **Script Editor** button on the toolbar or right-click in the trace window and choose **Edit as Text**.



```
###########################################################################
##  Copyright (C) 2004 Computer Access Technology Corporation            ##
##                                                                       ##
##  This SASTrainer(TM) generation file contains sample code for         ##
##  wait sessions and conditional branching. It is assumed sample        ##
##  code is to be modified before being generated to a real SAS device.  ##
###########################################################################

# Include necessary definition files supplied by CATC.
# The path for include files is considered to start
# in the SASTracer/Trainer program directory.

%include "Generation\Include\Settings.inc"
%include "Generation\Include\PrimitivesDecl.inc"
%include "Generation\Include\SMPFramesDecl.inc"
%include "Generation\Include\WaitCommands.inc"

Set GenerationMode     = GEN_MODE_SAS_INITIATOR
set Speed = LINK_SPEED_3G

# Each generation file must have this main block
Generation
{
    OUTPUT_ON

    #######################################################################
    # Setting timeout value for future wait sessions (µs)
    set WaitTimeout = 239

    #######################################################################
    # Simple wait session with no conditional branching
    WAIT_FOR ( WF_ACK WF_SATA_X_RDY WF_OPEN_RESPONSE )

    #######################################################################
    # Simple wait session with no conditional branching
    # with timeout (previous global timeout value assumed)
    WAIT_FOR ( WF_ACK WF_SATA_X_RDY WF_OPEN_RESPONSE WF_TIMEOUT )

    #######################################################################
    # Simple wait session with no conditional branching
    # with custom timeout (global timeout value ignored and unchanged)
    WAIT_FOR (566) ( WF_ACK WF_SATA_X_RDY WF_OPEN_RESPONSE WF_TIMEOUT )


    #######################################################################
    # Advanced wait sessions with conditional branching
    #######################################################################

    wait  # no timeout value specified - it means we assuyme current global W
    {
        when ( WF_ACK WF_SATA_SYNC )            do
        {
            ACK  (16)
```

Figure 5.12: Script Editor.

5.8.1 Script Editor Toolbar

The Script Editor toolbar contains buttons for saving your edits, navigating, searching, and other functions.

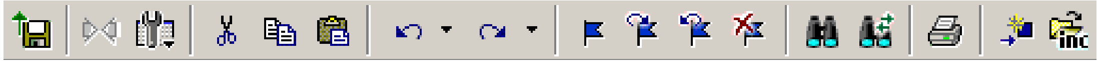


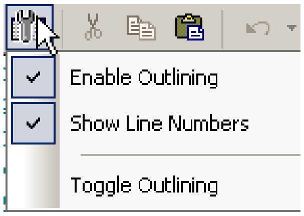
Figure 5.13: Script Editor Toolbar.

The buttons have the following functions:

	Save. Saves your edits and immediately updates the setting bars and Frames shown in the trace window.		Add/Remove bookmark. Allows markers to be set or removed to aid in navigation.
	View Options. Opens a menu with three options: Enable Outlining, Toggle Outlining, and Show Line Numbers. See **View Options Menu** below.		Go to next bookmark.
	Cut.		Go to previous bookmark.
	Copy.		Clear all bookmarks.
	Paste.		Find.
	Undo.		Find and Replace.
	Redo.		Go to Trace View
	Print.		Go to Definition of Selected Keyword.
		inc	Open File under Cursor. Opens the file pointed to with the mouse in the script. This command works with **Include** statements.

View Options Menu

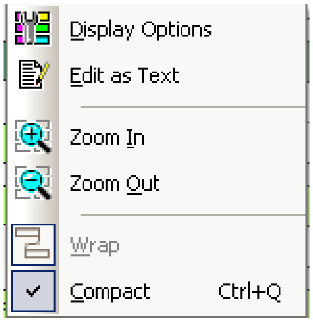
The View Options button displays a menu with the following options:


Enable Outlining
Show Line Numbers
Toggle Outlining

- **Enable Outlining**: Adds an expandable/collapsible tree structure to the left side of the Script Editor showing the hierarchical relationships of the script lines.
- **Show Line Numbers**: Adds line numbers to the left side of the Script Editor window.
- **Toggle Outlining**: Switches between collapsed and expanded states.

Pop-up Menu

Left-click anywhere in the script window to open a pop-up menu with the following options:


Display Options
Edit as Text
Zoom In
Zoom Out
Wrap
Compact Ctrl+Q

- **Display Options**: Selects what information to display. See “Display Options” on page 440.
- **Edit as Text**: Opens the Script Editor.
- **Zoom In**: Increases the size of the displayed elements
- **Zoom Out**: Decreases the size of the displayed elements
- **Wrap**: Wraps displayed packets within the window.
- **Compact**: Displays each row on one line only, with no wrapping

File Tabs

At the bottom of the window is a tab that shows the name of the **.ssg** file. If your **.ssg** file has an Include statement in it, the supporting Include files automatically open when the **.ssg** file is first opened. Tabs for the opened Include files appear at the bottom of this window.

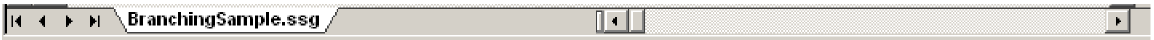
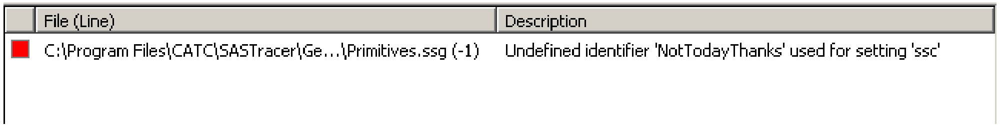

BranchingSample.ssg

Figure 5.14: File Tab.

Error Log

Whenever you create a scripting error, a log opens at the bottom of the application window. When the error is corrected, the window automatically closes.



	File (Line)	Description
🟥	C:\Program Files\CATC\SASTracer\Ge...\Primitives.ssg (-1)	Undefined identifier 'NotTodayThanks' used for setting 'ssc'

Figure 5.15: Log.

Tooltips

The Script Editor window includes extensive tooltips for each keyword. To see a tooltip, hold the mouse pointer over a keyword.

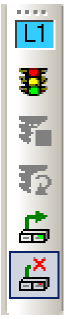
5.9 Multi-Port Trainer Script Assignments to Links

If more than one port of Trainer is licensed, after you open a generator file (**.ssg**) or create a new generator file ("Creating a Traffic Generation File" on page 363), you can assign the script to one or more ports.

Click the Ⓟ Port Configuration button to open the Set Port Configuration dialog (see "Port Configuration" on page 108). Select a port configuration. For example, Trainer may be on Port1 and Port 2 or Port3 and Port4.

After you select port configuration, the Assign Active Script/Remove Assigned Script for Link 1, 2, 3, or 4 buttons have colors. For example, for Trainer on Ports 1 and 2, the buttons are L1 L2 L3 L4.

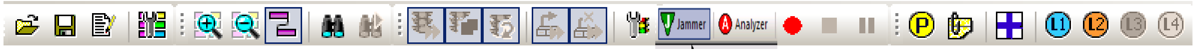
After you open or create a script in the Trainer window, click the L1 or L2 button to assign the script to Port 1 or Port 2. A display appears to the left of the script in the Trainer window:



That link now has link-specific Start, Stop, Resume, Connect, and Disconnect buttons. (See the previous page for the button descriptions.)
Use the link-specific buttons to control each link separately.

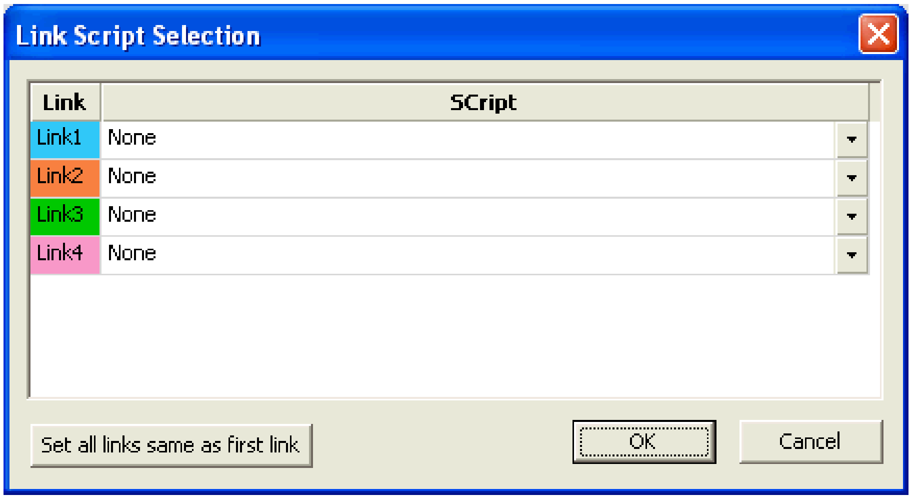
You can click the L1 or L2 button again to remove the script from the link.

After you select port configuration, the Trainer toolbar changes to display the Generation buttons Start All Generation, Stop All Generation, Resume All Generation, Connect All Link, and Disconnect All Link:


Jammer
Analyzer
P
L1
L2
L3
L4

Use these buttons to control all links.

You can click to open the Link Script Selection script assignment dialog.

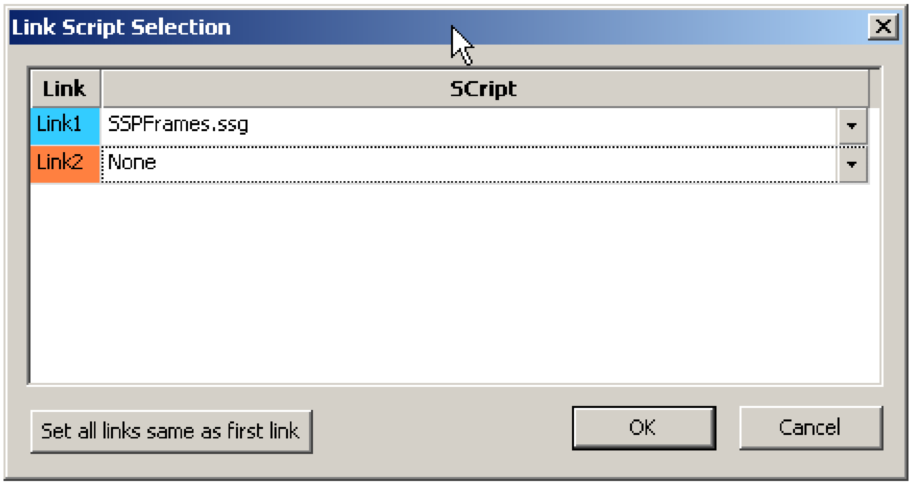


Link Script Selection

Link	Script
Link1	None
Link2	None
Link3	None
Link4	None

Set all links same as first link
OK
Cancel

For any available Link, you can select any open script from the Script drop-down list.



Link Script Selection

Link	Script
Link1	SSPFrames.ssg
Link2	None

Set all links same as first link
OK
Cancel

After you select an open script, you can assign or remove a link for that script by clicking **Assign Active Script/Remove Assigned Script for Link.**

5.10 Generating Traffic

After the **.ssg** file has been opened onscreen, recording and traffic generation can begin at any time.

1. (optional) Click ● Record to begin the recording.

2. If the script does not have a connect block built into it, connect the exerciser to the DUT by clicking the **Connect Link** button . Clicking this button causes the generator to invoke the various settings in your script (for example, the global settings) and then establish a connection.
3. Click the **Start Generation** button on the Toolbar.

While generating traffic, a bar appears on the right of the trace view, indicating that traffic generation is taking place. (The green light on the Traffic signal button also blinks during traffic generation).

5.10.1 Stop Traffic Generation

Normally, traffic generation stops automatically when the application reaches the end of the Generator file.

To manually stop traffic generation, click the **Stop Generation** button .

5.10.2 Resume Traffic Generation

If traffic generation is stopped prior to the end of the script, it can be resumed.

To resume traffic generation, click the **Resume Generation** button .

5.11 Sierra Trainer Generation Language

The Sierra Trainer File Generation Language is an API that allows you to separate traffic into text commands. These commands are used construct primitives and frames that are sent to the host or the device.

5.11.1 File Structure

Traffic Generation files (***.ssg**) should have the following structure:

Declarations

- Global generation settings
- Constants
- Data patterns
- Chain of symbols (primitives, raw data)
- Packet templates

Note: Some declared objects could be used in further declarations as long as they are previously declared. No forward declarations are allowed at this time.

Generation Blocks

- List of generation instructions

Note: It is possible to create many generation blocks, but currently only a block with the name 'Generation' executes. (Calls of some blocks from another blocks are not currently allowed.)

5.11.2 Language

Comments

#' is the Comment symbol. The line remainder after this symbol is ignored.

/*' '*/' is a Comment Block. All the text between '/' '*' and '*' '/' is ignored.

```
/*
  This is an example of a block of comments.
*/
```

Includes

The directive **%include "FileName.inc"** includes the file **FileName.inc**. This lets you add common definitions and templates into new scripts.

The language parser makes sure the same file is not included more than once.

Example:

```
%include "SomeInc.inc"
# This directive actually includes file 'SomeInc_1.inc'.
```

%inline is the same as **%include**, but without the Language parser check.

Settings

The **Set "Constant Name" = Value** statement sets different constants/modes using the following value types:

- ❑ Predefined constants (TRUE, FALSE, ON, OFF, INFINITE)
- ❑ Numbers

Examples:

```
Set AutoAlignSATA=ON
Set WaitTimeOut=239
```

Constants

Only unsigned integers can be defined as constants. Some constants are predefined in Sierra Trainer.

Examples:

```
Const SOME_HEX_DATA = 0xAABBFFEE #defines hexadecimal constant
Const SOME_DEC_DATA = 12     # defines decimal constant
Const "SOME DEC DATA" = 64     # defines decimal constant
Const "Some Hex Data" = 0xCDCDBEBE
```

Predefined Constants

- ❑ TRUE
- ❑ FALSE

- ON
- OFF
- INFINITE

Data Patterns

Data patterns are streams of hexadecimal values. Using '["]' lets the user include constants or predefined data pattern in another pattern.

Examples:

```
DataPattern PATTERN_1 = AAAABBBB [SOME_HEX_DATA] EEEEFFFF   1210ABB1
AAAABBBB 1210ABB1 AAAABBBB 1210ABB1 AAAABBBB 1210ABB1 ["SOME DEC
DATA"] 1210AB
DataPattern PATTERN_2 = 00000000 11111111 22222222 33333333 AAAABBBB
55556666 FEFEFEFE CDCDCDCD 9999BBBB 12343434 6767676B 56BBFF
DataPattern PATTERN_3 = [PATTERN_1] FFFFFFFF EEEEEEEE [SOME_HEX_DATA]
DataPattern SOME_PATTERN = BBBBBBBB DDDDDDDD
```

Primitives

Primitives can be defined using the following:

- Byte values ('k' indicates control symbol). The 10b codes are calculated based on the current running disparity
- Primitives are completely interchangeable with SymChains.

Declaring Raw Data Definitions

Primitive primitive_name = byte_data …   byte_data # (byte_data is Decimal, Hex, 10b, K type or D type format)

SynChain raw_data_name = byte_data …   byte_data # (byte_data is Decimal, Hex, 10b, K type or D type format)

RawData { param_data …   param_data } #(param_data is byte_data, primitive or variables)

Example:

```
Primitive "CHAIN (ONE)"  = kBC 1E 1E 1E kBC 1A 0F
SymChain ChainTwo = k28.5 D12.3 D10.2 D11.6
SymChain ChainThree = k28.3 3EA 25 k18 IFA
Primitive SOF = kBC 18 E4 67
Primitive EOF = kBC 18 F0 9B
SymChain raw_data_1 = K28.1 D23.3 D11.4 D14.6
SymChain raw_data_2 = 345 160 023 K15.3 K28.1 D23.3 D11.4 D14.6 # some
RD errors will occur
raw_data_1 ( 1000 ) # send defined above pattern raw_data_1 1000 times
raw_data_2 (  10 )  # send defined above pattern raw_data_2   10 times
raw_data_2 ( 195 )  # send defined above pattern raw_data_2  195 times

RawData { 217 2E1 351 362 }# send RawData pattern - some RD errors
will occur
RawData { K28.1 D23.3 D11.4 D14.6 }    # send RawData pattern
```

Sending OpenAddressFrame Using Standard Frame Templates

```
 SendOpenAddressFrameSTP    {
SourceAddress      = { 500805EF FFFF0041 }
DestinationAddress = { 500062B0 00000030
}
      ArbitrationWaitTime = 0x1
      AccessZoneManagement= 0x0
      SourceZoneGroup     = 0x0
      ConnectionRate      = 0x8
      Features            = 0x0
      InitiatorConnectionTag = 0x1
      InitiatorPort       = 0x0
      MoreCompatibleFeatures = 0x0
      PathwayBlockedCount = 0x0
    # CRC = 0x050F19E0  # good crc    }
```

Sending the Same OpenAddressFrame Using Raw Data Mechanism

```
Set ScramblingMode =
SCRAMBLING_MODE_SAS
RawData {
 K28.5  D24.0  D30.0  D01.4
   21     08     00     01
   50     00     62     B0
   00     00     00     30
   50     08     05     EF
   FF     FF     00     41
   00     00     00     01
   00     00     00     00
   05     0F     19     E0
 K28.5  D24.0  D07.3  D31.4 }
* CRC is inserted manually
```

```
# RawData with variables embedded
RawData {
K28.5 D24.0 D30.0 D01.4
@variableName1
50 00 62 B0
00 00 00 30
50 08 05 EF
$C
00 00 00 01
00 00 00 00
SendCRC
K28.5 D24.0 D07.3 D31.4 }
}
```

When there are variable values in RawData, you must include SendCRC command instead of last dword. Otherwise, wrong CRC value will be sent. The constraints are:

- Variables are not allowed on First and LAST DWORD (instead of start/end frames).
- SendCRC is only supported on last DWORD before end of frame.

- ☐ Raw 10 bits codes. This definition might cause running disparity errors.

Example:

```
Primitive "CHAIN (TWO)" = 305 2D4 1E4 362
```

- ☐ Mixed bytes and 10b codes. This definition might cause running disparity errors.

Example:

```
Primitive "CHAIN (TWO)" = 305 2D4 1E4 362 ["CHAIN (ONE)"]
```

Packets/ Frames

Using the “Frame” or “Packet” keyword, you can define a frame of traffic to use in the generation stream. Declarations of prolog and epilog may be mixed with field declarations.

```
Frame "name" : "parent name"
{
Field Definition 0: "Field Name : Field Length = Default Value"
…
Field Definition n: "Field Name : Field Length = Default Value"
Primitive Definition 0: "Primitive name, offset, count"
…
Primitive Definition m: "Primitive name, offset, count"
Prolog = "primitive name"
Epilog = "primitive name"
}
```

Field Definition

- ☐ Field length is in bits. '*' means that the length is variable and is set based on the assigned value.
- ☐ Field starting offset is calculated from frame start based on the length of the previous fields.

Examples:

```
Field32     : 32 = 0xAABBFFEE
FrameType   : 8  = 12
HashedDest  : 24 = HEX_DATA
Reserved1   : 8  = 0xDA
Field16     : 16 = 0xAAAA
Reserved2   : 8  = 0xAD
CRC         : 32
```

Data field Definition

- **Data = { pattern }**: Pattern is assigned to Data.
- **Data = count, value**: A pattern of "count" times "value" is assigned to Data.
- **Data = count, start value, step**: A pattern of values starting with "start value" with steps of "step" and a length of "count" is assigned to Data.

Primitive definition. Primitives are inserted into the frame payload. Primitive definitions are inherited by descended frame templates.

- ☐ Assigning '*' clears all previous settings (maybe from parent frame template).
- ☐ Offset specifies the DWORD offset where this primitive is inserted in the Frame.
- ☐ Count specifies how many times to repeat the primitive.

Examples:

```
Primitive : *
Primitive : SOF, 48   # where 48 = offset
Primitive : "CLOSE (NORMAL)", 36, 5   # where 5 = repeat
```

Prolog and Epilog define Primitive chains to be used at the beginning and end of the frame.

Examples:

```
Prolog = SOF # For this frame primitive 'SOF' is a Prolog.
Epilog = EOF # For this frame primitive 'EOF' is an Epilog.
```

Frames can be derived from other Frames, therefore inheriting the layout of the parent Frame. In this case, the user may:

- ☐ Change Prolog and Epilog.
- ☐ Change default field values.
- ☐ Add new fields.

Frame Examples

```
Frame  Some_Frame
{
    Field32     : 32 = 0xAABBFFEE
    FrameType   : 8  = 12
    HashedDest  : 24 = HEX_DATA
    Reserved1   : 8  = 0xDA
    Field16     : 16 = 0xAAAA
    Reserved2   : 8  = 0xAD
    Data        :  * = PATTERN_1
    CRC         : 32

    Primitive : *
    Primitive : SOF, 48
    Primitive : SOF, 96
    Primitive : "CLOSE (NORMAL)", 36, 5

    Prolog = SOF
    Epilog = EOF
}
Frame Some_Frame_1 : Some_Frame
{
        Field32 = "Some Hex Data"
        Data    = { 11111111 22222222 33333333 44444444 55555555 }
        Opcode    : 128, 8, 0x2A
        LBA       : 64

        Primitive : *
        Primitive : "CLOSE (NORMAL)", 24, 48

        Prolog = "CHAIN (ONE)"
        Epilog = "CHAIN (ONE)"
    }
```

5.11.3 Generation Block

Sierra Trainer generates the stream that is defined in this block.

```
Generation
{
Chain Definition (Repeat = N, Idle = M)
Chain Definition (N, M)
Chain Definition
Frame Definition
Frame Definition (RunningDisp = ON/OFF)
Frame Definition
{
Field Definition
Data Definition
} (Repeat = N, Idle = M, RunningDisp = ON/OFF)
```

5.11.4 Definitions

Chain Definition:

- ❑ Without any parameters, the chain is sent once.
- ❑ With “Repeat” and “Idle” parameters, the chain is sent N times and then nothing is sent (idle) M times. “Repeat” and “Idle” are optional.

Frame Definition

- ❑ Without any parameters, send the frame based in default values.
- ❑ With “RunningDisp” ON, send the frames based on default values and insert a running disparity error.
- ❑ With parameters overriding or adding to a template frame, with or without injection of an overriding or adding to a template frame, with or without injection of running disparity error.

Field Variable Declarations

You can declare a variable (var_name) as a frame of type (frame_type):

```
$var_name = frame_type
```

Note: Frame variables can be declared/re-declared and used many times.

Changing Frame Fields

You can change some fields in a frame variable.

```
Change var_name { field_name = value }
```

Preprocessor Integer Arithmetic

You can declare DWORD variables, make arithmetic operations, and use them in field and parameters assignments.

Note: Arithmetic expressions are allowed only in numeric variable assignments.

Examples:

Legal Operations

```
x = 2
y = ( z = 12 ) + ( SOME_DEC_DATA + 36 ) / 8
z = 0x1 << 5
s = "Some Hex Data" # constant may be used in operations


x++
y--
z += ( x + y )
x = ( ( y & 0xFF ) >> 5 ) / 12

SOF ( Repeat = x, Idle = y )



X
{
Field16 =  0xEEEE   # Example of the data payload assignment which
usesbothintegervariables,constants,hexliteralsanddatapatterns
Data    =  { y y y y 7a7a7a7a "Some Hex Data" "Some Hex Data" 8b8b8b8b
z z z z [PATTERN_3] }
}
( Repeat = 10, Idle = y )  # uses integer variable for parameter/
setting.

Illegal operations

x = y + 2
SOF ( Repeat = (x+y)*7 )
# - illegal, use z = (x+y)*7  SOF ( Repeat = z ) instead
```

5.11.5 Loops

Loops can be used in two modes:

1. Using an integer number, loop a specified number of loops. This number has to be smaller than 64,000.

2. Using the word “infinite”, loops for ever.

```
Loops ( loop_count/Infinite )
{
 send instructions
 assignments
 change values
 send instructions
}
Example:
LOOP( 50 )
{
        "CHAIN (ONE)"
        "CHAIN (TWO)"
        Some_Frame
        $Y = Some_Frame { Data = 256, 0xFEFEFEFE }
        Y
        Change Y { Field32 = x }
        Y
        Y
}
```

Note: The Trainer can support up to 4 levels of nested loops.

5.11.6 Controlling Connection Speed

When you use the AdvanceConnect feature, the Trainer always tries to connect to the drive with the highest possible speed. In this case, the **Set Speed** command is not used.

If you want to connect to the drive with a specific speed, you may either:

1. Set the AdvanceConnect feature to TRUE and limit with the desired phy-capability bits. For example, if you want to set the speed to 3G, then set the Gen4 and Gen3 phy-capability bits to 0.
2. Or set the AdvanceConnect feature to FALSE, and set/hardcode the desired speed using the **Set Speed** command.

Notice in the Trainer script example "SSPFrame_12G.ssg":

- ☐ AdvanceConnect is set to "True":

```
Set advanceConnect= TRUE
```

- ☐ All the phy-capability bits are set to support Gen3:

```
Set OOB_SpeedNeg_Phy_g4WithoutSSC = 0
      #Set to 1 for 12Gbps support, otherwise 0
Set OOB_SpeedNeg_Phy_g4WithSSC = 0
      #Set to 1 for 12Gbps support, otherwise 0
```

- ☐ The highest speed is set to SAS12.

This script will work on the highest supported speed by the DUT.

Note: To run the same script on a M6-4 or M6-2, the Gen4 phy-capability bits need to be OFF in order to be compatible.

5.11.7 Controlling TTIU

Three methods are available for connecting the Trainer:

- ☐ Use the **Connect** command to connect and perform transmitter training.
- ☐ Use the new commands to handle the transmitter training manually (see Manual Transmitter Training Commands and Descriptions below).
- ☐ Use the Send_Train_TX_Window command to send transmitter training automatically and use other commands for speed negotiation.

Manual Transmitter Training Commands and Descriptions

SendRAWTTIU(Pattern_marker 32bits of BMC encoded TTIU)

This command is for transmitting a Raw_TTIU. i.e BMC encoded 32 bits TTIU can be specified here. The user has the flexibility to specify the pattern marker.

Example:

```
Generation
{
Send_raw_ttiu( ffffc0000 FF C00F FC00 FF C00F FC00 FF C00F FC00 FF C00F
FC00 FF C1F0 7C00 FF C00F FC00 FF C00F FC00 FF C00F FC00}
Idle(54)
}
```

Where “ffffc0000” is the pattern marker.

Send_TTIU (32'b DATA/Variable, Idle count, Repeat number)

This instruction is mainly for sending a specific TTIU with variable number of Idles. 32 bit TTIU value can be specified either by directly specifying the 32 bit data or by specifying a variable. When the variable name is recognized, the trainer reads the data in the specified variable and considers it as the TTIU value. The Idle count defines the number of idles to be transmitted after the 32 bit TTIU and the repeat number defines the number of times the same TTIU is to be transmitted.

Example:

```
Var32 @ttiu =0x00006000
Generation {
Send_ttiu (0x00006000, 0x36, 0xA)    //ttiu with specific data
Send_ttiu (@ttiu, 0x36, 0xA)         //TTIU with variable
}
```

Wait_For_TTIU(DATA/Change TTIU , MASK

This instruction waits for a specific TTIU. During the execution of this instruction, the previously transmitted TTIU is transmitted. The user can trigger a wait for a specific TTIU or change the TTIU, or a part of TTIU, by specifying the 32 bit mask value.

The default mask value is set to all ones. The application waits for all 32 bits to match the received TTIU. Changing the mask value provides the flexibility to wait for some specific bits in the TTIU. Giving the Change_TTIU command with mask value waits for any change in the specified Bits in the Received TTIU compared to the previously received TTIU.

Example:

```
Generation
{
Wait_for_ttiu  (change_ttiu , 0x00004000) //waiting for change in tx_init
                                            bit of TTIU
Send_ttiu ((0x00006000, 0x36, 0xA)
Wait_for_ttiu (0x0000A000 , 0X00008000)  //waiting for train comp bit to
                                           go high
}
```

LRT: Last received TTIU

This instruction is for accessing the last received TTIU. The user can access the received TTIU and reuse it as required.

Example:

```
{

@ttiu_mask=0x0006000
@ttiu=LRT
@ttiu_temp=@ttiu and @ttiu_mask
If(ttiu_temp=0006000)
{
Send_ttiu(0x0006000)
}

}
```

Training_ERROR_COUNT

This instruction is for accessing the error count of the received Dwords. This gives flexibility to the user to change the remote tx parameters to get the optimal link with minimal errors.

Example:

```
Var32 @error_count
Generation
{
Send_ttiu ((0x00006000, 0x36, 0xA)
Wait_ttiu (change_ttiu , 0x00004000)
@error_count= Training_ERROR_COUNT;
If(@error_count<2)
{
Send_ttiu ((0x0000A000, 0x36, 0xA)

 }
}
```

Reset_Training_ERROR_COUNT

During manual Tx_Training resetting error _count can be done using this command.

Example：

```
Var32 @error_count
Generation
{
Send_ttiu ((0x00006000, 0x36, 0xA)
Wait_ttiu (change_ttiu , 0x00004000)
@error_count= Training_ERROR_COUNT;
If(@error_count<2)
{
Send_ttiu ((0x0000A000, 0x36, 0xA)
Rest_Training_Error_count
 }
}
```

Change_Local_tx_parameter(16'b data/variable)

This instruction is to change the Local tx parameters. It takes either 16 bit data or 16 bit variable which represents the control word of the TTIU. When this command is given, the 32 bit data or 16 bit variable value is written to the constant variable memory location (address location is 511)

Example:

```
var32 @received_control
var32 @Status
var32 @ control=0x00100000
var32 @temp
Generation
{
 Send_ttiu ((0x00006000, 0x36, 0xA)
 Wait_ttiu (change_ttiu , 0x00004000)
 Change_Local_tx_parameter (0x0400)  //requesting to change the tx
                                       parameters to reference_1
@received_control=LRT
@temp=@received_control & 0x1111000 //0x11110000 is the mask data so that
                                      the variable contains only the
                                      controlwordofthereceivedttiu.

Change_Local_tx_parameter(@temp)//variable as input

@status= Local_ Tx_status_word
@temp=@status | @control
Send_ttiu(@temp,0x36,0xA)
}
```

Where “0x0400” is the control word of TTIU.

Local_ Tx_status_word

This instruction is for getting the status of the local tx parameters for the previous requested tx parameter change. This is a 32 bit word in which the LSB 16-bit contains the status word and MSB 16 bits are ZEROS.

Set OOB_SpeedNeg_TX_TAT:Tx_training_analysis_time

This setting defines the time for Link analysis i.e., the time for counting errors in the received dwords. At the end of this period, the trainer requests for new attached tx_phy change depending on the error count in Auto Tx_training mode. This is a global setting.

SendRAWTTIU(Pattern_marker 32bits of BMC encoded TTIU)

This command is for transmitting a Raw_TTIU. i.e BMC encoded 32 bits TTIU can be specified here. The user has the flexibility to specify the pattern marker.

Example：

```
Generation
{
Send_raw_ttiu( ffffc0000 FF C00F FC00 FF C00F FC00 FF C00F FC00 FF C00F
FC00 FF C1F0 7C00 FF C00F FC00 FF C00F FC00 FF C00F FC00}
Idle(54)
}
```

Where “ffffc0000” is the pattern marker.

Send_TTIU/SendTTIU (32'b DATA/Variable, Idle count, Repeat number)

This instruction is mainly for sending a specific TTIU with variable number of idles .32 bit TTIU value can be specified either by directly specifying the 32 bit data or by specifying a variable.(when the variable name is given trainer reads the data in the specific variable and considers it as TTIU value).Idle count defines the number of idles to be transmitted after the 32 bit TTIU and repeat number defines the number of times the same TTIU to be transmitted.

Note: The proper BALANCE bit is calculated automatically, regardless of its value in the SendTTIU.

Example:

```
Var32 @ttiu =0x00006000

Generation {

Send_ttiu (0x00006000, 0x36, 0xA)      //ttiu with specific data

Send_ttiu (@ttiu, 0x36, 0xA)           //TTIU with variable

}
```

Wait_For_TTIU/WaitforTTIU(DATA/Change TTIU , MASK)

This instruction waits for specific TTIU. During this instruction previous transmitted TTIU will be transmitted. User can trigger wait for specific TTIU, Change in TTIU or part of TTIU by specifying 32'bit mask value.

Default mask value is set to all ones. i.e waits for all 32'bits to match with the received TTIU. Changing the mask value gives the flexibility to wait for some specific bits in the TTIU. Giving Change_TTIU with mask value waits for any change in the specified Bits in the Received TTIU compared to the previous received ttiu.

Example:

```
Generation

{

Wait_for_ttiu  (change_ttiu , 0x00004000)          //waiting for change in tx_init bit of TTIU

Send_ttiu ((0x00006000, 0x36, 0xA)

Wait_for_ttiu (0x0000A000 , 0X00008000)       //waiting for train comp bit to go high

}
```

LRT: Last received TTIU:

This instruction is for having access to the last received TTIU. User can have access to the received ttiu and reuse it as required. Example for using this command in the script is as follows:

```
{

@ttiu_mask=0x0006000

@ttiu=LRT

@ttiu_temp=@ttiu and @ttiu_mask

If(ttiu_temp=0006000)

{

Send_ttiu(0x0006000)

}


}
```

Training_ERROR_COUNT

This instruction is for having access to the error count of the received Dwords. This will give flexibility to user to decide on changing remote tx parameters to get the optimal link with minimal errors.

Example:

```
Var32 @error_count

Generation

{

       Send_ttiu ((0x00006000, 0x36, 0xA)

      Wait_ttiu (change_ttiu , 0x00004000)

      @error_count= Training_ERROR_COUNT;

     If(@error_count<2)

    {
        Send_ttiu ((0x0000A000, 0x36, 0xA)


     }
}
```

Reset_Training_ERROR_COUNT / ResetTrainingErrorCount

During manual tx_trainig resetting error _count can be done using this command.

```
Ex: Var32 @error_count
Generation
{
        Send_ttiu ((0x00006000, 0x36, 0xA)
       Wait_ttiu (change_ttiu , 0x00004000)
       @error_count= Training_ERROR_COUNT;
      If(@error_count<2)
     {
        Send_ttiu ((0x0000A000, 0x36, 0xA)
      Rest_Training_Error_count
     }
}
```

Change_Local_tx_parameter / changelocaltxparameter (16'b data/variable)

This instruction is to change the Local tx parameters. It takes either 16 bit data which represents the control word of the TTIU or 16'b variable that represents control word of the TTIU.

when this command is given ,32 bit data or variable value will be written in to a constant variable memory location (address location is 511)

Example:

```
 var32 @received_control
var32 @Status
var32 @ control=0x00100000
var32 @temp
Generation
{
        Send_ttiu ((0x00006000, 0x36, 0xA)
   Wait_ttiu (change_ttiu , 0x00004000)
 Change_Local_tx_parameter (0x0400)  //requesting to change the tx parameters to reference_1
          @received_control=LRT
     @temp=@received_control & 0x1111000 //0x11110000 is the mask data so that the variable contains only the control word of the received ttiu.
    Change_Local_tx_parameter(@temp)//variable as input
   @status= Local_ Tx_status_word
   @temp=@status | @control
   Send_ttiu(@temp,0x36,0xA)
}
```

Local_ Tx_status_word

This instruction is for getting the status of the local tx parameters for the previous requested tx parameter change. This is a 32 bit word in which LSB 16-bit contains status word and MSB 16bits are ZEROS.

Set OOB_SpeedNeg_TX_TAT:Tx_training_analysis_time

This setting defines the time for Link analysis i.e time for counting errors in the received dwords after this time trainer request for new attached tx_ph y change depending on the error count in Auto Tx_training mode . This is a global setting.

Send_RAW_TTIU / SendRawTTIU(Pattern_marker 320bits of BMC encoded TTIU ,IDLE count, Repeat count)

This command is for transmitting a Raw_ttiu. i.e BMC encoded 320 bits ttiu can be specified here.User is given a flexibility to specify the pattern marker.

```
Generation
{
  sendrawttiu(3ff 3ff 000 000
        3ff 000 3ff 000
        3ff 000 3ff 000
        3ff 000 3ff 000
        3ff 000 3ff 000
        3e0 3ff 01f 000
        3ff 000 3ff 000
```

```
             3ff 000 3ff 000
             3ff 000 3ff 000
            ,0x3a ,0x10 )
  }
```

For TRAINING_ERROR_COUNT, Change_local_tx_parameter, Tx_status_word

commands hardware creates separate variables with pre defined address. When user specifies this command, software should compile the commands in to variable commands with specific pre defined variable address

Other Tx-training related Commands

1. LINK_SPEED_12G : For setting speed to 12G
2. Set OOB_SpeedNeg_Phy_g4 WithoutSSC : Sets the G4 Without SSC bit of phy capability window
3. Set OOB_SpeedNeg_Phy_g4 WithSSC : sets the G4 with SSC bit of phy capability window
4. SEND_TRAIN_TX_WINDOW : Start sending tx training window.
5. Set OOB_SpeedNeg_MTTT : Sets the Maximum tx training time for Tx-training Window

Set Auto_TxUpdate:

This setting is for manual Tx training. When Auto_TxUpdate is set to true, the Local tx parameters will be updated automatically depending on the received control word and as result the Tx_status_word is updated accordingly. When set to FALSE, Tx parameters is controlled by the script.

TRAINING_ERROR_COUNT, Change_local_tx_parameter, Tx_status_word

This command instructs the hardware to create separate variables with pre-defined addresses. When the user specifies this command, the software compiles the commands into variable commands with specific pre-defined variable addresses.

5.11.8 Trainer Script Enhancements

The Trainer script language can already produce SAS/SATA Primitive Sequences and Frames.

The Trainer script enhancements described in this section allow generation of Commands and Application Layer sequences (as in the Exerciser), by processing received frames, making complex decisions, and generating the contents of frame in run-time, for both RX and TX. Variables can keep the run-time state of the bus. Low-level commands can manipulate variables and use variables to create patterns.

Trainer language can perform SATA compliance tests with fast SSD devices and provide a SSD performance test tool with limited output data patterns. Trainer has sequential/ random LBA command generation and full NCQ support.

Trainer can be programmed to act as SAS Initiator, SAS Target, SATA Host, or SATA Device.

SAS Initiator

As an Initiator, Trainer can send commands in all protocols (SSP/STP/SMP) and interact with its peer to complete the command in normal conditions and some popular error conditions. Limitations are:

- ☐ Uses only one command at a time.
- ☐ Does not save Read data or reuse bulk read data for next commands.
- ☐ Sends only limited Write data patterns.
- ☐ Has tight flow control, due to limited RX frame processing.

SAS Target

As a Target, Trainer can receive commands in all protocols (SSP/STP/SMP) and respond to them in normal conditions or some popular error conditions. Limitations are:

- ☐ Uses only one command at a time. Command queuing is not supported.
- ☐ Does not save incoming write data. Sends back data for all LBAs or generates counter/random data. Cannot be used as a real formatted partition.
- ☐ Has tight flow control, due to limited RX frame processing.

SATA Host

As a Host, Trainer can send commands and complete them in normal or some popular error conditions. SATA Host can issue NCQ commands, necessary for SATA compliance tests on SSD devices. Limitations are:

- ☐ Does not save Read data or reuse bulk read data for next commands.
- ☐ Sends only limited Write data patterns.

SATA Device

As a Device, Trainer can receive commands and respond to them in normal or some popular error conditions. Limitations are:

- ☐ Uses only one command at a time. Command queuing is not supported.
- ☐ Does not save incoming write data. Sends back data for all LBAs or generates counter/random data. Cannot be used as a real formatted partition. To use the Trainer as a SATA Device in real configurations, only tools like IO-METER (that can work with un-partitioned and un-formatted drives) can be used.

Variable Definition

Variable definition is like definitions in programming languages. You can define up to 512 DWORD (32-bit) variables. There is no constraint on variable names, except you cannot use keywords. Variable scopes are general and you should define them in the script header before the generation block.

The syntax of variable definition is:

```
VAR32 @VariableName1, @VariableName2, ...
VAR64 @VariableName
```

VAR64 holds field values greater than 32 bits, such as SASAddress.

Note: Variable names always start with @.

Assigning Variable Values

You can set variable values in different ways:

Constant value:

```
@varName1 = 1234
```

Other variable value:

```
@varName1 = @varName2
```

Result of expression on other variables:

```
@varName1 = @varName1 + @varName2
```

Fields of last received frame:

```
@varName1 = (SSPFrame)LRF::FrameType,
```

where LRF is Last Received Frame

Note: Specifying packet type (SSPFrame) before LRF causes last received frame to be this packet type, and field start-bit position is calculated according to the packet-type definition.

Part of last received frame:

```
@varName1 = LRF[startBitOffset:endBitOffset],
where offsets are bit based
```

Example:

```
SendSSPFrameCommand_Initiator
    {Data = LRF[startBitOffset:endBitOffset] )
Tag = 0x101}
```

The constraints are 1) Length bigger than 64 bit is not supported and 2) Offsets (StartBitOffset and EndBitOffset) should be in same DWORD, except for length bigger than 32.

Random values:

```
@varName1 = Random
```

Expression on Variables

Mathematical expressions, such as sum, subtract, and shift:

```
@varName1 + @varName2
@varName1 - @ varName2
@varName1 & @varName2
@varName1 | @varName2
```

```
@varName1  <<  2
```

Logical expressions, such as compare, equal, not, and, and or:

```
@varName1  >  @varName2
@varName1 < @ varName2
@varName1 ==  @varName2
@varName1 != @ varName2
 (logical expression1) &&  (logical expression2)
(logical expression1) || (logical expression2)
```

Complex expressions (combination of different operators) with prioritizing supported:

```
(@varName1 + @varName2) > @varName3
```

If/While in Logical Expressions

Like programming languages, scripts allow conditional statements.
The **if/while** syntaxes are:

```
If (expression)then
{
        ….
}
else
{
       ….
}

While(@VarName)
{
     …….
}
```

Example for if, then else:

```
@HT_RxFISType = LRF[0:7]
#LRF_SATA_FIS_TYPE_START_BIT:LRF_SATA_FIS_TYPE_END_BIT
if  (@HT_RxFISType == SATA_FIS_TYPE_DMA_ACTIVATE)   then  {…}
 else { if (@HT_RxFISType == SATA_FIS_TYPE_DATA) then  {…}
           else { if (@HT_RxFISType == SATA_FIS_TYPE_RD2H)  then  {…}
} }
```

Example for while:

```
while (@NCQ_Temp0)   {
      @NCQ_Temp1= @NCQ_Temp1 >> 1
      If (@NCQ_Temp1 != 0) then { … }
      @NCQ_Temp0 = @NCQ_Temp1 & 0x00000001     }
```

Note: In this release, **while** condition is limited to simple variable values only. Combining operators is not allowed in **while** expressions. You should move such expressions inside **while** block.

Note: Nested **while** and **if** are supported.

Wait/When/Do in Logical Expressions

The **wait/when/do** syntaxes are:

```
wait (time)
{when
{exp}do
{
      ….
}
elsewhen
{
{exp}do
{
      ….
}
on_timeout
{
      ….
}}
```

Example:

```
wait  { #no timeout use global WaitTimeout value default 1000 useconds
(1 ms)
    when  {WF_OPEN_ACCEPT}   do   { … }
    elsewhen  {WF_OPEN_REJECT}   do   { … }
    on_timeout  { … }     }
```

Example:

```
wait_for (100000)  { WF_OPEN_ACCEPT  WF_TIMEOUT}  { … } # (100 ms)
```

Note: Nested wait should not exceed 2 deep. Use a procedure call to extend wait logic sequence. Wait + Wait_For ok.

Using Variable Values in Creating Patterns on Bus

In creating patterns to send on bus, trainer script allows using variables. In these cases, because the created pattern is dynamic, it is not possible to do scrambling and calculating in software code. These tasks are done in the hardware engine. To activate, set “Auto scramble mode” in “on” state.

The following examples show uses of variables in creating patterns.

Use variable for field value:

```
SendOpenAddressFrameSSP
{
InitiatorPort = 0x1
    InitiatorConnectionTag = @variableName1
…...
}
```

The constraints are:

- ❑ Field Length bigger than 64 bit is not supported.
- ❑ Field StartBitOffset and EndBitOffset should be in same DWORD, except for length bigger than 32.

Use LRF directly for field value:

```
SendSSPFrameCommand_Initiator
{
    Data = LRF[startBitOffset:endBitOffset]
    Tag  = 0x101
}
```

The constraints are:

- ☐ Length bigger than 64 bit is not supported.
- ☐ Offsets (StartBitOffset and EndBitOffset) should be in same DWORD, except for length bigger than 32.

```
SendSSPFrameCommand
 {
#Data = {00112233 @variableName1 @variableName2 44556677}
 }


RawData {
 K28.5  D24.0  D30.0  D01.4
              @variableName1
              50     00     62     B0
              00     00     00     30
              50     08     05     EF
              $C
              00     00     00     01
              00     00     00     00
              SendCRC
              K28.5  D24.0  D07.3  D31.4 }
}
```

When there are variable values in RawData, you must include **SendCRC** command instead of last DWORD. Otherwise, wrong CRC value will be sent.

The constraints are:

- ☐ Variables are not allowed on First and LAST DWORD (instead of start/end frames).
- ☐ **SendCRC** is only supported on last DWORD before end of frame.

```
SendSATAFrame
{
  SATA_SOF
  SATA_DATA ( 0x11223344 )
  SATA_DATA (@variableName1)
  SATA_DATA ( 0x55667788 )
  #SATA_CRC ( 0x99AACCBB ) # good crc - can be changed to bad
  SATA_EOF
}
```

If **SATA_CRC** command is not included, trainer engine computes and inserts correct CRC in pattern.

Timer

Trainer script syntax allows using some timers. You can start a timer anywhere. The timer current value is loadable on variable to be used in expressions and conditions on this expression. There are four timers, named A, B, C, and D.

Starting timer (setting timer value to zero) syntax is:

```
CLEAR_TIMER_A
CLEAR_TIMER_B
CLEAR_TIMER_C
CLEAR_TIMER_D
```

Loading timer current value in variables:

```
@varName1 =TIMER_A
@varName1 =TIMER_B
@varName1 =TIMER_C
@varName1 =TIMER_D
```

Example:

```
CLEAR_TIMER_A
While(@Counter < MaxPeriodCount) {
   … @Counter = TIMER_A … }
```

PATTERN Counter

Trainer script syntax allows you to use counters on a number of defined events in generation settings.

Syntax for loading counters in variables is:

```
@varName1 = COUNT_REC_RESOURCE_OUTPUT_A
@varName1 = COUNT_REC_RESOURCE_OUTPUT_B
@varName1 = COUNT_REC_RESOURCE_OUTPUT_C
@varName1 = COUNT_REC_RESOURCE_OUTPUT_D
@varName1 = COUNT_REC_RESOURCE_OUTPUT_E
@varName1 = COUNT_REC_RESOURCE_OUTPUT_F
```

Syntax for clearing (resetting) counters is:

```
CLEAR_REC_RESOURCE_OUTPUT_A
CLEAR_REC_RESOURCE_OUTPUT_B
CLEAR_REC_RESOURCE_OUTPUT_C
CLEAR_REC_RESOURCE_OUTPUT_D
CLEAR_REC_RESOURCE_OUTPUT_E
CLEAR_REC_RESOURCE_OUTPUT_F
```

Example:

```
CLEAR_REC_RESOURCE_OUTPUT_A
While(@Counter < MaxPrimitiveCount) {
      … @Counter = COUNT_REC_RESOURCE_OUTPUT_A … }
```

Procedure Definition

Procedures allow creating simple syntaxes for complex reusable parts in scripts. You can write such code once as a procedure and use everywhere required.

Procedure definition syntax is:

```
procedure procedureName
{
...
}
```

Calling procedure syntax is:

```
Call procedureName
```

5.11.9 Sierra Trainer Generation Commands

General Commands

IDLE (n)	Generator will insert n idle DWORDs into the generation stream.
CLEAR_CREDIT_AVAIL	This commands clears the credit established with the command WF_CREDIT_AVAIL. (See WF_CREDIT_AVAIL in following section on Wait Commands for explanation).
RD_ERROR	Generator will insert one idle DWORD into the generation stream, which will intentionally break RD sequence creating RD error.
CONNECT	Generator will go through connection sequence using current GenFile settings (gen mode, speed, and so on). Generation will not resume until connection is established.
DISCONNECT	Generator will break existing connection to DUT.
PAUSE	Generator will come to a break and the user will be able to resume generation by pressing Resume button on Generation toolbar. Generator shall transmit idle DWORDs while in the Pause.
OUTPUT_ON	Takes the Trainer out of Electric Idle state. If it is already out of Electric Idle, this is a NOP.
OOB Commands	
COMINIT	Generator will send COMINIT OOB signals using current COMINIT settings.
COMRESET	Generator will send COMRESET OOB signals using current COMRESET settings.
COMWAKE	Generator will send COMWAKE OOB signals using current COMWAKE settings.
COMSAS	Generator will send COMSAS OOB signals using current COMSAS settings.
SATA_ALIGN	Generator will go through SATA_ALIGN stage of SATA SpeedNeg process using current SATA_ALIGN settings.

SATA_D10_2	Generator will go through SATA_D10_2 stage of SATA SpeedNeg process using current SATA_D10_2 settings.
SPEED_NEG_RCDT	Generator will go through SPEED_NEG_RCDT stage of SAS SpeedNeg process using current SPEED_NEG_RCDT settings.
SPEED_NEG_ALIGN0	Generator will go through SPEED_NEG_ALIGN0 stage of SAS SpeedNeg process using current SPEED_NEG_ALIGN0 settings.
SPEED_NEG_ALIGN1	Generator will go through SPEED_NEG_ALIGN1 stage of SAS SpeedNeg process using current SPEED_NEG_ALIGN1 settings.
Set Speed = LINK_SPEED_1_5G	Generator will change speed to 1.5G (if MultiSpeed is enabled). This setting is not applied when Advanced Connect is set.
Set Speed = LINK_SPEED_3G	Generator will change speed to 3G (if MultiSpeed is enabled). This settings is not applied when Advanced Connect is set.
Set Speed = LINK_SPEED_6G	Generator will change speed to 6G (if MultiSpeed is enabled). This setting is not applied when Advanced Connect is set.
Set Speed = LINK_SPEED_12G	Generator will change speed to 12G (if MultiSpeed is enabled). This setting is not applied when Advanced Connect is set.
Set RX_Speed = LINK_SPEED_XXG	Allows user to set the specific speed for the receivers. XX = 1.5 / 3 / 6 / 12 LINK_SPEED_1_5G LINK_SPEED_3G LINK_SPEED_6G LINK_SPEED_12G
DevSlp	Makes the device sleep signal high. Trainer doesn’t go to Electric idle mode automatically after Devslp command. We can force trainer to go to DC Idle mode using the “disconnect “ command after Devslp command. This command works when Generation mode is GEN_MODE_SAS_INITIATOR or GEN_MODE_SATA_HOST

Exit_DevSlp	Makes Device sleep signal low (comes out of device sleep mode). This command works when Generation mode is GEN_MODE_SAS_INITIATOR or GEN_MODE_SATA_HOST
SEND_TRAIN_RX_WINDOW	(This Command is used in Train Windows). This command works exactly same as "Send_Train_TrainDone."
SEND_TRAIN_TX_WINDOW	(This Command is used in Train Windows).
Send_Phy_Capability	Generator will send PHY Capability Bits. (this command is used in SNW3).
Send_Train_TrainDone	Generator will send Train/Train Done Patterns. (This Command is used in Train Windows).
Delay (#)	Generator will wait until # ns before executing next command.
Power_Expansion_On(n)	Switch on power expansion card. The Default value is POWER_SOURCE_5V | POWER_SOURCE_12V. The power source can be combination of POWER_SOURCE_1_2V, POWER_SOURCE_1_5V, POWER_SOURCE_3_3V, POWER_SOURCE_5V, POWER_SOURCE_12V
Power_Expansion_Off(n)	Switch off power expansion card. The Default value is POWER_SOURCE_5V | POWER_SOURCE_12V.The power source can be combination of POWER_SOURCE_1_2V , POWER_SOURCE_1_5V , POWER_SOURCE_3_3V, POWER_SOURCE_5V, POWER_SOURCE_12V
Exit (ExitCode)	Call this command in any branch of the Trainer program to stop execution. After exit, the Port Status dialog displays the exit code. **Note:** The Trainer GUI has LED indicators: Green is for pass. Red is for fail. No color is for unknown or for user to review.
set_trainer_interconnect_signal_1 or settrainerinterconnectsignal_1	Set these signals to allow other ports to wait on them using WF_TRAINER_INTERCONNECT_SIGNAL_1
set_trainer_interconnect_signal_2 or settrainerinterconnectsignal_2	Set these signals to allow other ports to wait on them using WF_TRAINER_INTERCONNECT_SIGNAL_2

set_trainer_interconnect_signal_3 or settrainerinterconnectsignal_3	Set these signals to allow other ports to wait on them using WF_TRAINER_INTERCONNECT_SIGNAL_3
set_trainer_interconnect_signal_4 or settrainerinterconnectsignal_4	Set these signals to allow other ports to wait on them using WF_TRAINER_INTERCONNECT_SIGNAL_4
TX_PHY_CAPABILITY	This command holds the 32-bit phy-capability value from the trainer-side. The command can be assign to a 32-bit variable and use it. Generator will copy the current “phy-capability” value to the variable it is assigned to. Example: @Trainer_Phycapability = TX_PHY_CAPABILITY
RECEIVED_PHY_CAPABILITYBITS	This command holds the 32-bit phy-capability value from the receiver-side. The command can be assign to a 32-bit variable and use it. Generator will copy the current “phy-capability” value to the variable it is assigned to. Example: @received_phycapability = RECEIVED_PHY_CAPABILITYBITS

SATA Commands

Look at STP sample file for syntax.

- ☐ SEND_SATA_FRAME
- ☐ SendSATAFrame
- ☐ SATAData
- ☐ SATA_Data
- ☐ SATACRC
- ☐ SATA_CRC
- ☐ SATAXXXX
- ☐ SATA_XXXX

Primitive Commands

The following is a list of SAS and SATA primitives declared in **Primitives.Decl.inc** as Symbol Chains. If you want to use these primitives in your script, you must also include **Primitives.Decl.inc** in your script.

- ☐ SOF
- ☐ EOF
- ☐ SOAF
- ☐ EOAF
- ☐ ALIGN (0)
- ☐ ALIGN (1)
- ☐ ALIGN (2)
- ☐ ALIGN (3)

- ☐ NOTIFY (ENABLE SPINUP)
- ☐ NOTIFY (RESERVED 0)
- ☐ NOTIFY (RESERVED 1)
- ☐ NOTIFY (RESERVED 2)
- ☐ ACK
- ☐ NAK (CRC ERROR)
- ☐ NAK (RESERVED 0)
- ☐ NAK (RESERVED 1
- ☐ NAK (RESERVED 2)
- ☐ CREDIT_BLOCKED
- ☐ RRDY (NORMAL)
- ☐ RRDY (RESERVED 0)
- ☐ RRDY (RESERVED 1)
- ☐ SATA_SOF
- ☐ SATA_EOF
- ☐ SATA_CONT
- ☐ SATA_DMAT
- ☐ SATA_HOLD
- ☐ SATA_HOLDA
- ☐ SATA_PMACK
- ☐ SATA_PMNAK
- ☐ SATA_PMREQ_P
- ☐ SATA_PMREQ_S
- ☐ SATA_R_ERR
- ☐ SATA_R_IP
- ☐ SATA_R_OK
- ☐ SATA_R_RDY
- ☐ SATA_SYNC
- ☐ SATA_WTRM
- ☐ SATA_X_RDY
- ☐ SATA_ERROR
- ☐ AIP (NORMAL)
- ☐ AIP (RESERVED 0)
- ☐ AIP (RESERVED 1)
- ☐ AIP (RESERVED 2)
- ☐ AIP (RESERVED 3)
- ☐ AIP (WAITING ON CONNECTION)
- ☐ AIP (WAITING ON DEVICE)
- ☐ AIP (WAITING ON PARTIAL)
- ☐ BREAK
- ☐ BROADCAST (CHANGE)
- ☐ BROADCAST (RESERVED 0)
- ☐ BROADCAST (RESERVED 1)
- ☐ BROADCAST (RESERVED 2)
- ☐ BROADCAST (RESERVED 3)
- ☐ BROADCAST (RESERVED 4)
- ☐ BROADCAST (RESERVED CHANGE 0)

- ☐ BROADCAST (RESERVED CHANGE 1)
- ☐ CLOSE (CLEAR AFFILIATION)
- ☐ CLOSE (NORMAL)
- ☐ CLOSE (RESERVED 0)
- ☐ CLOSE (RESERVED 1)
- ☐ ERROR
- ☐ HARD_RESET
- ☐ OPEN_ACCEPT
- ☐ OPEN_REJECT (BAD DESTINATION)
- ☐ OPEN_REJECT (CONNECTION RATE NOT SUPPORTED)
- ☐ OPEN_REJECT (NO DESTINATION)
- ☐ OPEN_REJECT (PATHWAY BLOCKED)
- ☐ OPEN_REJECT (PROTOCOL NOT SUPPORTED)
- ☐ OPEN_REJECT (RESERVED ABANDON 0)
- ☐ OPEN_REJECT (RESERVED ABANDON 1)
- ☐ OPEN_REJECT (RESERVED ABANDON 2)
- ☐ OPEN_REJECT (RESERVED ABANDON 3)
- ☐ OPEN_REJECT (RESERVED CONTINUE 0)
- ☐ OPEN_REJECT (RESERVED CONTINUE 1)
- ☐ OPEN_REJECT (RESERVED INITIALIZE 0)
- ☐ OPEN_REJECT (RESERVED INITIALIZE 1)
- ☐ OPEN_REJECT (RESERVED STOP 0)
- ☐ OPEN_REJECT (RESERVED STOP 1)
- ☐ OPEN_REJECT (RETRY)
- ☐ OPEN_REJECT (STP RESOURCES BUSY)
- ☐ OPEN_REJECT (WRONG DESTINATION)
- ☐ DONE (ACK/NAK TIMEOUT)
- ☐ DONE (CREDIT TIMEOUT)
- ☐ DONE (NORMAL)
- ☐ DONE (RESERVED 0)
- ☐ DONE (RESERVED 1)
- ☐ DONE (RESERVED TIMEOUT 0)
- ☐ DONE (RESERVED TIMEOUT 1)

SAS-Specific Script-Defined Constants

The following is a list of SAS-specific constants declared in AddressFramesDecl.inc as Symbol Chains. If you want to use these commands in your script, you must also include **AddressFramesDecl.inc** in your script.

- ☐ SAS_AF_DT_NO_DEVICE_ATTACHED
- ☐ SAS_AF_DT_END_DEVICE
- ☐ SAS_AF_DT_EDGE_EXPANDER_DEVICE
- ☐ SAS_AF_DT_FANOUT_EXPANDER_DEVICE
- ☐ SAS_AF_FT_IDENTIFY
- ☐ SAS_AF_FT_OPEN
- ☐ SAS_AF_PROTOCOL_SMP
- ☐ SAS_AF_PROTOCOL_SSP
- ☐ SAS_AF_PROTOCOL_STP

- SAS_AF_PROTOCOL_UNKNOWN
- SAS_AF_RATE_1_5_GBPS
- SAS_AF_RATE_3_GBPS
- SAS_AF_RATE_6_GBPS
- SAS_AF_RATE_12_GBPS
- SMP_FRAME_TYPE_REQUEST
- SMP_FRAME_TYPE_RESPONSE
- SMP_REPORT_GENERAL
- SMP_REPORT_MANUFACTURER_INFO
- SMP_DISCOVER
- SMP_REPORT_PHY_ERROR_LOG
- SMP_REPORT_PHY_SATA
- SMP_REPORT_ROUTE_INFO
- SMP_CONFIGURE_ROUTE_INFO
- SMP_PHY_CONTROL
- SSP_FRAME_TYPE_DATA
- SSP_FRAME_TYPE_XFER_RDY
- SSP_FRAME_TYPE_COMMAND
- SSP_FRAME_TYPE_RESPONSE
- SSP_FRAME_TYPE_TASK
- SSP_FRAME_TYPE_VENDOR
- MUX (LOGICAL 0)
- MUX (LOGICAL 1)
- BREAK_REPLY
- TRAIN
- TRAIN_DONE
- PS_ACK
- PS_NAK
- PS_REQ_PARTIAL
- PS_REQ_SLUMBER

Primitive Category

- **ALIGN**: 0, 1, 2, or 3
- **NOTIFY**: ENABLE SPINUP, RESERVED 0, RESERVED 1, or RESERVED 2
- ACK
- **NAK**: CRC ERROR, RESERVED 0, RESERVED 1, or RESERVED 2
- **RRDY**: NORMAL, RESERVED 0, RESERVED 1
- **AIP**: NORMAL, RESERVED 0, RESERVED 1, RESERVED 2, RESERVED 3, WAITING ON CONNECTION, WAITING ON DEVICE, or WAITING ON PARTIAL
- BREAK
- **CLOSE**: CLEAR AFFILIATION, NORMAL, RESERVED 0, RESERVED 1
- CREDIT BLOCKED
- OPEN ACCEPT
- **OPEN REJECT**: BAD DESTINATION, CONNECTION RATE NOT SUPPORTED, NO DESTINATION, PATHWAY BLOCKED, PROTOCOL NOT SUPPORTED, RESERVED ABANDON 0, RESERVED ABANDON 1, RESERVED ABANDON 2, RESERVED ABANDON 3, RESERVED CONTINUE 0, RESERVED CONTINUE 1, RESERVED INITIALIZE 0, RESERVED INITIALIZE 1, RESERVED STOP 0, RESERVED STOP 1, RETRY, STP

RESOURCES BUSY, or WRONG DESTINATION

- **BROADCAST**: CHANGE, RESERVED 0, RESERVED 1, RESERVED 2, RESERVED 3, RESERVED 4, RESERVED CHANGE 0, or RESERVED CHANGE 1
- **DONE**: ACK/NAK TIMEOUT, CREDIT TIMEOUT, NORMAL, RESERVED 0, RESERVED 1, RESERVED TIMEOUT 0, or RESERVED TIMEOUT 1
- SATA FLOW CTRL PRIMITIVE
- SATA IDLE PRIMITIVE
- **SAS PS PRIMITIVE**: PS_REQ_PARTIAL, PS_REQ_SLUMBER, PS_ACK, or PS_NAK

Wait Commands

Syntax:

```
WAIT_FOR { <command1> <command2> ... <group1> <group2> ... }
```

Wait Command Name	Description
WF_TIMEOUT	Timeout Credit Available When WF_TIMEOUT is requested in WAIT_FOR command, the wait session will be released after timeout has elapsed. The Timeout value can be set two different ways: 1. Through the global WaitTimeout setting that can appear anywhere in generation. Default value is 1000 microseconds. Syntax: Set WaitTimeout = <value> (in microseconds) 2. Through local WaitTimeout value for this specific wait session. Syntax: WAIT_FOR (<number_of_microseconds>) {WF_TIMEOUT <other_wait_commands>} In this case wait for other commands will be released no later then after number_of_microseconds, but global WaitTimeout value remains unchanged for future use. See **Generation\Include\WaitCommands.inc** in the program folder for the samples of syntax.
WF_SOF	primitive
WF_EOF	primitive
WF_SOAF	primitive
WF_EOAF	primitive
WF_ACK	primitive
WF_NAK_CRC_ERROR	primitive
WF_NAK_RESERVED_0	primitive
WF_NAK_RESERVED_1	primitive
WF_NAK_RESERVED_2	primitive

Wait Command Name	Description
WF_CREDIT_AVAIL	Credit Available This function is based on a 10-bit counter whose value can range from -512 to +511 (twos-complement). This counter is cleared by sending or receiving an OPEN_ACCEPT primitive, or by execution of a CLEAR_CREDIT_AVAIL command in the script. This counter is incremented by receiving any SAS RRDY primitive and is decremented by sending SAS SOF. The wait_for command will wait for this counter to have a positive value between +1 and +511. This wait_for condition is intended to be used before sending a SAS frame within a connection. ClEAR_CREDIT_AVAIL clears this credit function.
WF_CREDIT_BLOCKED_RECEIVED	CreditBlocked Received This function is based on a flip-flop which is cleared by sending or receiving an OPEN_ACCEPT primitive. It is set by receiving a CREDIT_BLOCKED primitive. It is intended to be used in conjunction with wf_credit_avail to prevent script hangs in those cases where there is not going to be any more credit granted.
WF_CREDIT_BLOCKED	primitive
WF_RRDY_NORMAL	primitive
WF_RRDY_RESERVED_0	primitive
WF_RRDY_RESERVED_1	primitive
WF_BREAK	primitive
WF_CLOSE_CLEAR_AFFILIATION	primitive
WF_CLOSE_NORMAL	primitive
WF_CLOSE_RESERVED_0	primitive
WF_CLOSE_RESERVED_1	primitive
WF_DONE_ACK_NAK_TIMEOUT	primitive
WF_DONE_CREDIT_TIMEOUT	primitive
WF_DONE_NORMAL	primitive
WF_DONE_RESERVED_0	primitive
WF_DONE_RESERVED_1	primitive
WF_DONE_RESERVED_TIMEOUT_0	primitive
WF_DONE_RESERVED_TIMEOUT_1	primitive
WF_ERROR	primitive
WF_HARD_RESET	primitive

Wait Command Name	Description
WF_AIP_NORMAL	primitive
WF_AIP_RESERVED_0	primitive
WF_AIP_RESERVED_1	primitive
WF_AIP_RESERVED_2	primitive
WF_AIP_RESERVED_WAIT_ON_PART	primitive
WF_AIP_WAIT_ON_CONN	primitive
WF_AIP_WAIT_ON_DEVICE	primitive
WF_AIP_WAIT_ON_PARTIAL	primitive
WF_IDENTIFY_FRAME	Identify Address Frame
WF_OPEN_FRAME	Open Address Frame
WF_SMP_REQUEST	SMP Request Frame
WF_SMP_RESPONSE	SMP Response Frame
WF_REC_RESOURCES_OUTPUT_A	Advanced Wait Condition A This command causes generation to wait for Event "A" to occur that you defined in the Generation Options dialog described at the end of this chapter.
WF_REC_RESOURCES_OUTPUT_B	Advanced Wait Condition B This command causes generation to wait for Event "B" to occur that you defined in the Generation Options dialog described at the end of this chapter.
WF_REC_RESOURCES_OUTPUT_C	Advanced Wait Condition C This command causes generation to wait for Event "C" to occur that you defined in the Generation Options dialog described at the end of this chapter.
WF_REC_RESOURCES_OUTPUT_D	Advanced Wait Condition D This command causes generation to wait for Event "D" to occur that you defined in the Generation Options dialog described at the end of this chapter.
WF_REC_RESOURCES_OUTPUT_E	Advanced Wait Condition E This command causes generation to wait for Event "E" to occur that you defined in the Generation Options dialog described at the end of this chapter.
WF_REC_RESOURCES_OUTPUT_F	Advanced Wait Condition F This command causes generation to wait for Event "F" to occur that you defined in the Generation Options dialog described at the end of this chapter.

Wait Command Name	Description
wf_trainer_interconnect_signal_1	Events used to signal from one port to another.
wf_trainer_interconnect_signal_2	Events used to signal from one port to another.
wf_trainer_interconnect_signal_3	Events used to signal from one port to another.
wf_trainer_interconnect_signal_4	Events used to signal from one port to another.
WF_OOB_COMINIT_DETECTED	COMINIT/COMRESET OOB detected
WF_COMRESET_COMINIT	COMINIT/COMRESET OOB completed
WF_OOB_COMSAS_DETECTED	COMSAS OOB detected
WF_COMSAS	COMSAS OOB completed
WF_OOB_COMWAKE_DETECTED	COMWAKE OOB detected
WF_COMWAKE	COMWAKE OOB completed
WF_OOBUNKNOWN	UNKNOWN OOB
WF_BLOCK1_MISC_RESERVED_0	reserved
WF_BLOCK1_MISC_RESERVED_1	reserved
WF_BLOCK1_MISC_RESERVED_2	reserved
WF_BLOCK1_MISC_RESERVED_3	reserved
WF_BLOCK1_MISC_RESERVED_4	reserved
WF_SATA_CONT	primitive
WF_SATA_DMAT	primitive
WF_SATA_EOF	primitive
WF_SATA_ERROR	primitive
WF_SATA_HOLD	primitive
WF_SATA_HOLDA	primitive
WF_SATA_PMACK	primitive
WF_SATA_PMNAK	primitive
WF_SATA_PMREQ_P	primitive
WF_SATA_PMREQ_S	primitive
WF_SATA_R_ERR	primitive
WF_SATA_R_IP	primitive
WF_SATA_R_OK	primitive
WF_SATA_R_RDY	primitive
WF_SATA_SOF	primitive
WF_SATA_SYNC	primitive
WF_SATA_WTRM	primitive
WF_SATA_X_RDY	primitive
WF_OPEN_ACCEPT	primitive
WF_OPEN_REJECT_BAD_DESTINATION	primitive
WF_OPEN_REJECT_CONN_RATE_NOT_SUPPORTED	primitive
WF_OPEN_REJECT_NO_DESTINATION	primitive
WF_OPEN_REJECT_PATHWAY_BLOCKED	primitive

Wait Command Name	Description
WF_OPEN_REJECT_PROTOCOL_NOT_SUPPORTED	primitive
WF_OPEN_REJECT_RETRY	primitive
WF_OPEN_REJECT_STP_RESOURCES_BUSY	primitive
WF_OPEN_REJECT_WRONG_DESTINATION	primitive
WF_OPEN_REJECT_RESERVED_ABANDON_0	primitive
WF_OPEN_REJECT_RESERVED_ABANDON_1	primitive
WF_OPEN_REJECT_RESERVED_ABANDON_2	primitive
WF_OPEN_REJECT_RESERVED_ABANDON_3	primitive
WF_OPEN_REJECT_RESERVED_CONTINUE_0	primitive
WF_OPEN_REJECT_RESERVED_CONTINUE_1	primitive
WF_OPEN_REJECT_RESERVED_INITIALIZE_0	primitive
WF_OPEN_REJECT_RESERVED_INITIALIZE_1	primitive
WF_OPEN_REJECT_RESERVED_STOP_0	primitive
WF_OPEN_REJECT_RESERVED_STOP_1	primitive
WF_ALIGN_0	primitive
WF_ALIGN_1	primitive
WF_ALIGN_2	primitive
WF_ALIGN_3	primitive
WF_NOTIFY_ENABLE_SPINUP	primitive
WF_NOTIFY_RESERVED_0	primitive
WF_NOTIFY_RESERVED_1	primitive
WF_NOTIFY_RESERVED_2	primitive
WF_BROADCAST_CHANGE	primitive
WF_BROADCAST_RESERVED_0	primitive
WF_BROADCAST_RESERVED_1	primitive
WF_BROADCAST_RESERVED_2	primitive
WF_BROADCAST_RESERVED_3	primitive
WF_BROADCAST_RESERVED_4	primitive
WF_BROADCAST_RESERVED_CHANGE_0	primitive
WF_BROADCAST_RESERVED_CHANGE_1	primitive
WF_BLOCK2_MISC_RESERVED_0	reserved
WF_BLOCK2_MISC_RESERVED_1	reserved
WF_TRAIN	primitive
WF_TRAIN_DONE	primitive
WF_BREAK_REPLY	primitive
WF_MUX_LOGICAL_0	primitive
WF_MUX_LOGICAL_1	primitive
WF_PS_REQ_PARTIAL	primitive
WF_PS_REQ_SLUMBER	primitive

Wait Command Name	Description
WF_PS_ACK	primitive
WF_PS_NAK	primitive

Wait Command Groups

Wait Command Group	Group Contents
WF_TIMEOUT	WF_TIMEOUT_BLOCK_ONE WF_TIMEOUT_BLOCK_TWO
WF_ALL_SOF	WF_SOF
	WF_SOAF
WF_ALL_EOF	WF_EOF
	WF_SOAF
WF_NAK	WF_NAK_CRC_ERROR
	WF_NAK_RESERVED_0
	WF_NAK_RESERVED_1
	WF_NAK_RESERVED_2
WF_RRDY	WF_RRDY_NORMAL
	WF_RRDY_RESERVED_0
	WF_RRDY_RESERVED_1
WF_CREDIT_OK	WF_CREDIT_AVAIL
	WF_CREDIT_BLOCKED_RECEIVED
WF_CLOSE	WF_CLOSE_CLEAR_AFFILIATION
	WF_CLOSE_NORMAL
	WF_CLOSE_RESERVED_0
	WF_CLOSE_RESERVED_1
WF_DONE	WF_DONE_ACK_NAK_TIMEOUT
	WF_DONE_CREDIT_TIMEOUT
	WF_DONE_NORMAL
	WF_DONE_RESERVED_0
	WF_DONE_RESERVED_1
	WF_DONE_RESERVED_TIMEOUT_0
	WF_DONE_RESERVED_TIMEOUT_1
WF_AIP	WF_AIP_NORMAL
	WF_AIP_RESERVED_0
	WF_AIP_RESERVED_1
	WF_AIP_RESERVED_2
	WF_AIP_RESERVED_WAIT_ON_PART
	WF_AIP_WAIT_ON_CONN
	WF_AIP_WAIT_ON_DEVICE
	WF_AIP_WAIT_ON_PARTIAL

Wait Command Group	Group Contents
WF_REC_RESOURCES	WF_REC_RESOURCES_OUTPUT_A
	WF_REC_RESOURCES_OUTPUT_B
	WF_REC_RESOURCES_OUTPUT_C
	WF_REC_RESOURCES_OUTPUT_D
	WF_REC_RESOURCES_OUTPUT_E
	WF_REC_RESOURCES_OUTPUT_F
WF_RCV_STATUS	WF_SATA_R_ERR
	WF_SATA_R_OK
WF_PM_REQ	WF_SATA_PMREQ_P
	WF_SATA_PMREQ_S
WF_PM_STATUS	WF_SATA_PMACK
	WF_SATA_PMNAK
WF_OPEN_REJECT	WF_OPEN_REJECT_BAD_DESTINATION
	WF_OPEN_REJECT_CONN_RATE_NOT_SUPPORTED
	WF_OPEN_REJECT_NO_DESTINATION
	WF_OPEN_REJECT_PATHWAY_BLOCKED
	WF_OPEN_REJECT_PROTOCOL_NOT_SUPPORTED
	WF_OPEN_REJECT_RETRY
	WF_OPEN_REJECT_STP_RESOURCES_BUSY
	WF_OPEN_REJECT_WRONG_DESTINATION
	WF_OPEN_REJECT_RESERVED_ABANDON_0
	WF_OPEN_REJECT_RESERVED_ABANDON_1
WF_OPEN_REJECT (continued...)	WF_OPEN_REJECT_RESERVED_ABANDON_2
	WF_OPEN_REJECT_RESERVED_ABANDON_3
	WF_OPEN_REJECT_RESERVED_CONTINUE_0
	WF_OPEN_REJECT_RESERVED_CONTINUE_1
	WF_OPEN_REJECT_RESERVED_INITIALIZE_0
	WF_OPEN_REJECT_RESERVED_INITIALIZE_1
	WF_OPEN_REJECT_RESERVED_STOP_0
	WF_OPEN_REJECT_RESERVED_STOP_1
WF_OPEN_RESPONSE	WF_OPEN_ACCEPT
	WF_OPEN_REJECT
WF_ALIGN	WF_ALIGN_0
	WF_ALIGN_1
	WF_ALIGN_2
	WF_ALIGN_3
WF_NOTIFY	WF_NOTIFY_ENABLE_SPINUP
	WF_NOTIFY_RESERVED_0
	WF_NOTIFY_RESERVED_1
	WF_NOTIFY_RESERVED_2

Wait Command Group	Group Contents
WF_BROADCAST	WF_BROADCAST_CHANGE
	WF_BROADCAST_RESERVED_0
	WF_BROADCAST_RESERVED_1
	WF_BROADCAST_RESERVED_2
	WF_BROADCAST_RESERVED_3
	WF_BROADCAST_RESERVED_4
	WF_BROADCAST_RESERVED_CHANGE_0
	WF_BROADCAST_RESERVED_CHANGE_1
WF_SAS_PS_REQ	WF_PS_REQ_PARTIAL
	WF_PS_REQ_SLUMBER
WF_SAS_PS_STATUS	WF_PS_ACK
	WF_PS_ACK

Predefined Constants

Predefined Constant	Internal Value
GEN_MODE_ERROR	0
GEN_MODE_SATA_HOST	1
GEN_MODE_SATA_DEVICE	2
GEN_MODE_SAS_INITIATOR	3
GEN_MODE_SAS_TARGET	4
GEN_LINK_SPEED_1_5G	00
GEN_LINK_SPEED_3G	01
GEN_LINK_SPEED_6G	10
SCRAMBLING_MODE_NONE	0
SCRAMBLING_MODE_SAS	1
SCRAMBLING_MODE_SATA	2

Generation Settings

Setting	Default Value	Description
Global Settings		
GenerationMode	>>>>>	Generation Mode - must be defined or no generation will take place. Possible Values: GEN_MODE_SATA_HOST GEN_MODE_SATA_DEVICE GEN_MODE_SAS_INITIATOR GEN_MODE_SAS_TARGET Default Value: GEN_MODE_ERROR - undefined mode

Setting	Default Value	Description
MultiSpeedMode	0	When set, the change of speed within Generation block is allowed with following syntax: set Speed = LINK_SPEED_1_5G / LINK_SPEED_3G / LINK_SPEED_6G
Output Disable	0	This very poorly named register bit forces the Trainer to output data. It is a little like the output_on script command except that its effect cannot be undone for the duration of the script. If this is turned on, none of the out-of-band commands will work, as the output enable is forced on.
SupportSNW1	1	When set, in "Connect command" SNW1 will be tried in Speed Negotiation phase Can only be set outside Generation block.
SupportSNW2	1	When set, in "Connect command" SNW2 will be tried in Speed Negotiation phase. Can only be set outside Generation block.
PauseTrnScrmblr.	0	When set, the generator pauses the Idle scrambler of Train/TrainDone pattern.
ReconnectOnRun	0	When "AdvanceConnect" and "ReconnectOnRun" are set, the "Connect" command forces the Trainer to disconnect the physical link before executing the "Connect" command. When "AdvanceConnect" is not set, this setting does not affect the Trainer.
AdvanceConnect	0	When set, the Trainer uses the "PHY Capability" and "SupportSNW" settings, instead of the "Set Speed" settings, for executing the "Connect" command.
OutputOffAfterDC	On Off	If set to On, Trainer puts DC Idle on line when it detects sync lost on the link.

Setting	Default Value	Description
AutoMode Settings		
AutoOOBMode	On	When set, the generator will go through the stages of bringing up the link automatically, including waiting for and responding to the device or host it is connected to.
AutoHoldMode	0	When set, the generator will respond automatically to Hold requests. Not supported for version 1.1 (reserved).
AutoDMAT	0	When set, the generator will respond automatically to DMAT requests. Not supported for version 1.1 (reserved).
AutoSpeedNeg	On	When set, the generator will automatically go throughthe speed negotiation process, for the speed set in the PINTERFACEC_SERDES register for the Trainer.
AutoAlignSATA	0	When set, the generator will automatically inserting the stream 2 Align(0) primitives every 254 DWORDS, as specified in the SATA spec.
AutoAlignSAS	On	When set, the generator will automatically inserting the stream Align primitives every 2048 DWORDS, as specified in the SAS spec.Two Align modes can be turned on simultaneously, to support STP
COMINIT Settings		
COMINIT_NegLen	800	The number of bursts to send as part of this OOB type.Each Burst is followed by an Idle. The Burst-Idle pairs are repeated the requested number of times, and then followed by the Negation_length of Idle.
COMINIT_IdleLen	480	Burst time between each OOB idle in OOBIs.During the specified period, the generator will send ALIGN(0) at the specified speed.
COMINIT_BurstLen	160	Idle time between each OOB burst in OOBIs.During the specified period, the generator will keep the line at electric idle.
COMINIT_NumBursts	6	Negation time at the end of the OOB signal in OOBIs.During the specified period, the generator will keep the line at electric idle.

Setting	Default Value	Description
COMWAKE Settings		
COMWAKE_NegLen	280	The number of bursts to send as part of this OOB type.Each Burst is followed by an Idle. The Burst-Idle pairs are repeated the requested number of times, and then followed by the Negation_length of Idle.
COMWAKE_IdleLen	160	Burst time between each OOB idle in OOBIs.During the specified period, the generator will send ALIGN(0) at the specified speed.
COMWAKE_BurstLen	160	Idle time between each OOB burst in OOBIs.During the specified period, the generator will keep the line at electric idle.
COMWAKE_NumBursts	6	Negation time at the end of the OOB signal in OOBIs.During the specified period, the generator will keep the line at electric idle.
COMSAS Settings		
COMSAS_NegLen	2400	The number of bursts to send as part of this OOB type.Each Burst is followed by an Idle. The Burst-Idle pairs are repeated the requested number of times, and then followed by the Negation_length of Idle.
COMSAS_IdleLen	1440	Burst time between each OOB idle in OOBIs.During the specified period, the generator will send ALIGN(0) at the specified speed.
COMSAS_BurstLen	160	Idle time between each OOB burst in OOBIs.During the specified period, the generator will keep the line at electric idle.
COMSAS_NumBursts	6	Negation time at the end of the OOB signal in OOBIs.During the specified period, the generator will keep the line at electric idle.
SATA Link Init Settings		
OOB_SATA_D102_Time	100000	D10.2 time for SATA link synchronization in OOBIs.During the specified period, the generator will transmit D10.2 symbols.
OOB_SATA_Align_Time	100000	ALIGN(0) time for SATA link synchronization in OOBIs.During the specified period, the generator will transmit ALIGN(0) primitives.

Setting	Default Value	Description
SAS Speed Negotiation Settings		
OOB_SAS_Align1_Time	81920	ALIGN(1) time for SAS speed negotiation in OOBIs.During the specified period, the generator will transmit ALIGN(1) primitives.
OOB_SAS_Align0_Time	81920	ALIGN(0) time for SAS speed negotiation in OOBIs.During the specified period, the generator will transmit ALIGN(0) primitives.
OOB_SAS_Interspeed_Time	750000	Interspeed time for SAS speed negotiation in OOBIs.During the specified period, the generator will keep the line at electric idle.
OOB_SpeedNeg_MTT.	29998080 OOBI	The maximum time in OOBI during which training phase of speed negotiation should be completed in Train-SNW.
OOB_SpeedNeg_SNTT.	2200 OOBI	The time in OOBI during which generator transmits phy capability bits in SNW-3. In Automatic connection This value is also used for the time during which generator sends Align0 and Align1 in SNW1 and SNW2.
OOB_SpeedNeg_BCT.	2200 OOBI	The time in OOBI during which generator transmits COMWAKE or D.C. idle during SNW-3.
OOB_SpeedNeg_MTTT	750000000 OOBI	The maximum time for transmitter training to complete during Train_Tx-SNW.
OOB_SpeedNeg_COEF_Setting.	Normal	The initial coefficient setting values to be transmitted in the Tx-training TTIU. The value can be one of these values :Normal, Reference-1, Reference-2, No-equalization.

Setting	Default Value	Description
Phy Capabilities Settings		
OOB_SpeedNeg_Phy_start		The START bit shall be set to one. The phy's receiver shall use this bit to establish the timing for the subsequent bits.
OOB_SpeedNeg_ Phy_txSSCtype		A TX SSC TYPE bit set to one indicates that the phy's transmitter uses center-spreading SSC when SSC is enabled. A TX SSC TYPE bit set to zero indicates that the phy's transmitter uses down-spreading SSC when SSC is enabled or that the phy does not support SSC.
OOB_SpeedNeg_Phy_RLLR		The REQUESTED LOGICAL LINK RATE field indicates if the phy supports multiplexing and, if so, the logical link rate that the phy is requesting.
OOB_SpeedNeg_ Phy_g1WithoutSSC		A G1 WITHOUT SSC bit set to one indicates that the phy supports G1 (i.e., 1.5 Gbps) without SSC. A G1 WITHOUT SSC bit set to zero indicates that the phy does not support G1 without SSC.
OOB_SpeedNeg_ Phy_g1WithSSC		A G1 WITH SSC bit set to one indicates that the phy supports G1 (i.e., 1.5 Gbps) with SSC. A G1 WITH SSC bit set to zero indicates that the phy does not support G1 with SSC.
OOB_SpeedNeg_ Phy_g2WithoutSSC		A G2 WITHOUT SSC bit set to one indicates that the phy supports G2 (i.e., 3 Gbps) without SSC. A G2 WITHOUT SSC bit set to zero indicates that the phy does not support G2 without SSC.
OOB_SpeedNeg_ Phy_g2WithSSC		A G2 WITH SSC bit set to one indicates that the phy supports G2 (i.e., 3 Gbps) with SSC. A G2 WITH SSC bit set to zero indicates that the phy does not support G2 with SSC.
OOB_SpeedNeg_ Phy_g3WithoutSSC		A G3 WITHOUT SSC bit set to one indicates that the phy supports G3 (i.e., 6 Gbps) without SSC. A G3 WITHOUT SSC bit set to zero indicates that the phy does not support G3 without SSC.
OOB_SpeedNeg_ Phy_g3WithSSC		A G3 WITH SSC bit set to one indicates that the phy supports G3 (i.e., 6 Gbps) with SSC. A G3 WITH SSC bit set to zero indicates that the phy does not support G3 with SSC.
OOB_SpeedNeg_ Phy_g4WithoutSSC		A G4 WITHOUT SSC bit set to one indicates that the phy supports G4 (12 Gbps) without SSC. A G4 WITHOUT SSC bit set to zero indicates that the phy does not support G4 without SSC.

Setting	Default Value	Description
OOB_SpeedNeg_ Phy_g4WithSSC		A G4 WITH SSC bit set to one indicates that the phy supports G4 (12 Gbps) with SSC. A G4 WITH SSC bit set to zero indicates that the phy does not support G4 with SSC.
OOB_SpeedNeg_Phy_Parity		The PARITY bit provides for error detection of all the SNW-3 phy capabilities bits. The PARITY bit shall be set to one or zero such that the total number of SNW-3 phy capabilities bits that are set to one is even, including the START bit and the PARITY bit.

Setting	Default Value	Description
SATA Speed Negotiation Settings		
OOB_SpeedNeg_RCDT	750000	Maximum time in OOBIs during the speed negotiation window for a transmitter to reply with ALIGN(1).
OOB_SpeedNeg_SNTT	163840	Time in OOBIs during which ALIGN(0) or ALIGN(1) is transmitted at each physical link rate during the speed negotiation sequence.
OOB_SpeedNeg_SNLT	153600	Time in OOBIs during which the transmitter shall transmit idle between rates during speed negotiation.
Speed Settings		
Speed	>>>>>	Link Speed Possible Values: LINK_SPEED_1_5G LINK_SPEED_3G LINK_SPEED_6G Default Value: LINK_SPEED_1_5G
RateMatching	0	Possible values: 0 (disabled) and 1 (enabled). When RateMatching is enabled, the software programs every other dword as Align(0) primitive, cutting the throughput in half. It is not recommended to use SendInc and SendBulk when you are employing RateMatching, since the automatically generated data will not get rate matched.
Scrambling Mode Settings		
Scrambling	>>>>>	Raw Data Scrambling Mode - Only those raw DWORDs will be scrambled that contain only data bytes (no 10-bit symbols or 'K' bytes. Scrambling is reset by changing ScramblingMode or by any valid SAS or SATA frame. When **Scrambling** is on, scrambling is done by Trainer engine. It automatically detects scrambling type (SAS or SATA) by start frame primitive. When **Scrambling** is off, data is sent without any scrambling. Possible Values: SCRAMBLING_MODE_NONE SCRAMBLING_MODE_SAS SCRAMBLING_MODE_SATA SCRAMBLING_MODE_AUTO Default Value: SCRAMBLING_MODE_AUTO

Setting	Default Value	Description
Wait Timeout Settings		
WaitTimeout	1000	Sets global WaitTimeout value in microseconds
AUTO_WAIT_SAS_AFTER Settings		
AUTO_WAIT_SAS_AFTER_ CLOSE_FOR_CLOSE	FALSE	When set, the generator will insert WAIT_FOR CLOSE command immediately after each CLOSE primitive.
AUTO_WAIT_SAS_AFTER_ EOF_FOR_ACK	FALSE	When set, the generator will insert WAIT_FOR ACK command immediately after each EOF primitive.
AUTO_WAIT_SAS_AFTER_ EOF_FOR_ACK_OR_NAK	FALSE	When set, the generator will insert WAIT_FOR ACK or NAK command immediately after each EOF primitive.
AUTO_WAIT_SAS_AFTER_ OPEN_FOR_OPEN_ACCEPT	FALSE	When set, the generator will insert WAIT_FOR OPEN_ACCEPT command immediately after each Open Address Frame.
AUTO_WAIT_SAS_AFTER_ OPEN_FOR_OPEN_REJECT	FALSE	When set, the generator will insert WAIT_FOR OPEN_REJECT command immediately after each Open Address Frame.
AUTO_WAIT_SAS_AFTER_ IDENTIFY_FOR_IDENTIFY_ FRAME	FALSE	When set, the generator will insert WAIT_FOR Identify Frame command immediately after each Identify Address Frame.
AUTO_WAIT_SAS_AFTER_ SMP_REQ_FOR_RESP	FALSE	When set, the generator will insert WAIT_FOR SMP Response Frame command immediately after each SMP Request Frame.
AUTO_WAIT_SAS_BEFORE Settings		
AUTO_WAIT_SAS_BEFORE_ CLOSE_FOR_CLOSE	FALSE	When set, the generator will insert WAIT_FOR CLOSE command right before each CLOSE primitive.
AUTO_WAIT_SAS_BEFORE_ SOF_FOR_CREDIT	FALSE	When set, the generator will insert WAIT_FOR CREDIT command right before each SOF primitive.
AUTO_WAIT_SAS_BEFORE_ IDENTIFY_FOR_IDENTIFY_ FRAME	FALSE	When set, the generator will insert WAIT_FOR Identify Frame command right before each Identify Address Frame.
AUTO_WAIT_SAS_BEFORE_ OPEN_ACCEPT_FOR_OPEN	FALSE	When set, the generator will insert WAIT_FOR Open Frame command right before each OPEN_ACCEPT primitive.
AUTO_WAIT_SAS_BEFORE_ OPEN_REJECT_FOR_OPEN	FALSE	When set, the generator will insert WAIT_FOR Open Frame command right before each OPEN_REJECT primitive.
AUTO_WAIT_SAS_BEFORE_ AIP_FOR_OPEN	FALSE	When set, the generator will insert WAIT_FOR Open Frame command right before each primitive of AIP group.
AUTO_WAIT_SAS_BEFORE_ SMP_RESP_FOR_REQ	FALSE	When set, the generator will insert WAIT_FOR SMP Request Frame command right before each SMP Response Frame.

Setting	Default Value	Description
AUTO_WAIT_SATA_AFTER Settings		
AUTO_WAIT_SATA_AFTER_ X_RDY_FOR_R_RDY	FALSE	When set, the generator will insert WAIT_FOR SATA_R_RDY command immediately after each case of SATA_CONT primitive following SATA_X_RDY primitive.
AUTO_WAIT_SATA_AFTER_ WTRM_FOR_STATUS	FALSE	When set, the generator will insert WAIT_FOR SATA_R_ERR or SATA_R_OK command immediately after each case of SATA_CONT primitive following SATA_WTRM primitive.
AUTO_WAIT_SATA_AFTER_ PMREQ_S_FOR_RESPONSE	FALSE	When set, the generator will insert WAIT_FOR SATA_PMACK or SATA_PMNAK command immediately after each case of SATA_CONT primitive following SATA_PMREQ_S primitive.
AUTO_WAIT_SATA_AFTER_ PMREQ_P_FOR_RESPONSE	FALSE	When set, the generator will insert WAIT_FOR SATA_PMACK or SATA_PMNAK command immediately after each case of SATA_CONT primitive following SATA_PMREQ_P primitive.
AUTO_WAIT_SATA_AFTER_ SYNC_FOR_SYNC	FALSE	When set, the generator will insert WAIT_FOR SATA_SYNC command immediately after each case of SATA_CONT primitive following SATA_SYNC primitive.
AUTO_WAIT_SATA_BEFORE Settings		
AUTO_WAIT_SATA_BEFORE _PMACK_FOR_PMREQ	FALSE	When set, the generator will insert WAIT_FOR SATA_PMREQ_S or SATA_PMREQ_P command right before each SATA_PMACK primitive.
AUTO_WAIT_SATA_BEFORE _PMNAK_FOR_PMREQ	FALSE	When set, the generator will insert WAIT_FOR SATA_PMREQ_S or SATA_PMREQ_P command right before each SATA_PMNAK primitive.
AUTO_WAIT_SATA_BEFORE _RERR_FOR_WTRM	FALSE	When set, the generator will insert WAIT_FOR SATA_R_ERR command right before each SATA_WTRM primitive.
AUTO_WAIT_SATA_BEFORE _ROK_FOR_WTRM	FALSE	When set, the generator will insert WAIT_FOR SATA_R_OK command right before each SATA_WTRM primitive.
AUTO_WAIT_SATA_BEFORE _RIP_FOR_SOF	FALSE	When set, the generator will insert WAIT_FOR SATA_R_IP command right before each SATA_SOF primitive.
AUTO_WAIT_SATA_BEFORE _R_RDY_FOR_X_RDY	FALSE	When set, the generator will insert WAIT_FOR SATA_X_RDY command right before each SATA_R_RDY primitive.

5.11.10 Auto Speed Negotiation

The commands SATA_D10.2, SATA_ALIGN, SPEED_NEG_ALIGN0 and SPEED_NEG_ALIGN1 operate differently based on the state of the Auto Speed negotiation (Asng) control bit (which is set or cleared by configuration memory blocks in the stream) and by the current SAS/SATA, Init/Targ state of the Trainer Engine. The table below illustrates different actions done by Trainer Engine executing SATA_D10.2, SATA_ALIGN, SPEED_NEG_ALIGN0 and SPEED_NEG_ALIGN1 commands based on Asng and Trainer Engine setup.

Command	AutoSpeedNeg	Actions
SATA_D10.2	0	Send D10.2 dwords until the count is exhausted, then move on to the next block in stream. The count is specified by the SPEED_NEG_PARAMETER control block.
	1	Send D10.2 dwords until the count is exhausted or an ALIGN_0 is detected (whichever comes first), then move on to the next block in the stream.
SATA_ALIGN	0	Send Align_0 primitives until the count is exhausted, then move on to the next block in the stream. The count is specified by the SPEED_NEG_PARAMETER control block.
	1	If GEN_MODE_SATA_HOST, send Align_0 primitives until the count is exhausted or a non-Align_0 primitive is detected (whichever comes first), then move on to the next block in the stream. If GEN_MODE_SATA_DEVICE, send Align_0 primitives until the count is exhausted or an Align_0 primitive is detected (whichever comes first), then move on to the next block in the stream.
SPEED_NEG_ALIGN0	0	Send Align_0 primitives until the count is exhausted, then move on to the next block in the stream.

Command	AutoSpeedNeg	Actions
	1	Send Align primitives until the count is exhausted, then move on to the next block in the stream. Start with Align_0, and switch to Align_1 if an Align_0 is detected.
SPEED_NEG_ALIGN1	0	Send Align_1 primitives until the count is exhausted.
	1	Do nothing at all.

5.11.11 Generation Options

Use the Generation Rules to set triggers and filters.

To display the Generation Options dialog, select **Generate > Generation Options** or click the **Setup Generation Options** button.

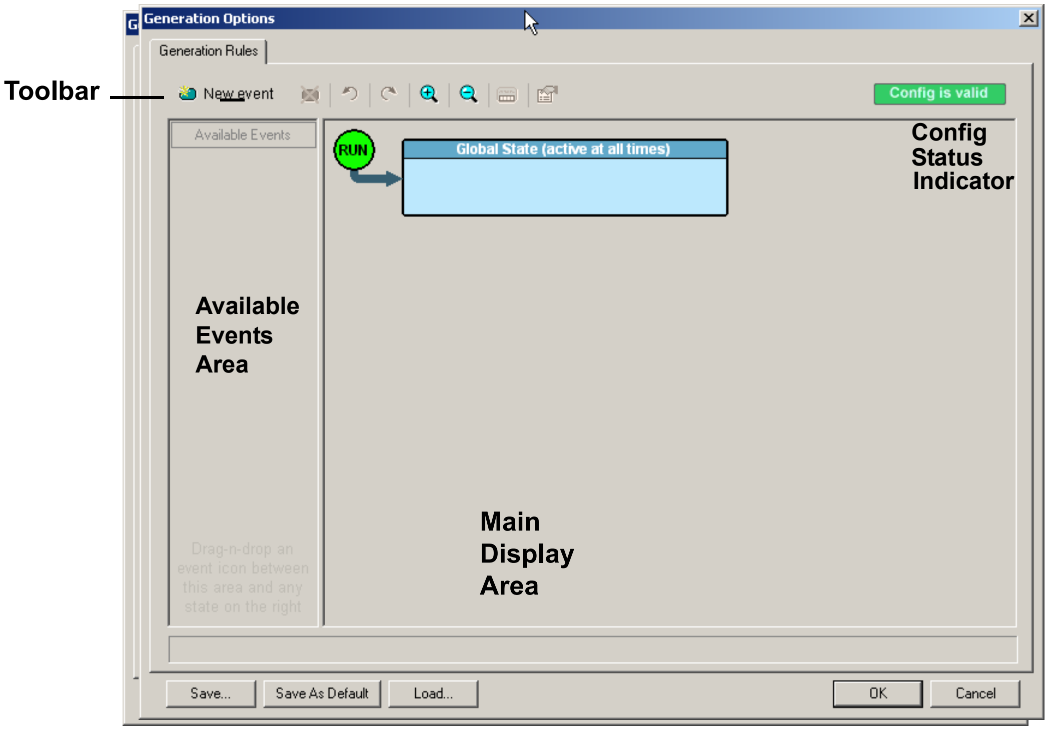

Toolbar
Generation Options
Generation Rules
New event
Config is valid
Available Events
RUN
Global State (active at all times)
Config Status Indicator
Available Events Area
Drag-n-drop an event icon between this area and any state on the right
Main Display Area
Save...
Save As Default
Load...
OK
Cancel

Figure 5.16: Generation Options Window.

The page has the following areas:

- **Toolbar:** Contains buttons that control the Generation Rules page.
- **Available Events Area:** Area where you can park Event buttons that you intend to use in the Main Display area.
- **Main Display Area:** Area where you configure trigger and filter rules. You config-

ure rules by dragging Event buttons from the Available Events area and then assigning actions to those buttons.

- ☐ **Config Status Indicator:** A button that indicates if the rule is valid or invalid. If a trigger or filter rule is configured correctly, the button is green and indicates Config is Valid. If a rule is not configured correctly, the button is red and indicates Config is Invalid.

Pop-Up Menus: When you right-click a button or area in the Generation Rules page, a context-sensitive pop-up menu appears that lets you do operations that relate to that button or area.

Properties Dialogs: When you click the Show/Hide Properties Dialog button for an event, action, or state, a dialog allows you to perform the same operations as in the pop-up menus.

5.11.12 Generation Rules Toolbar

The Generation Rules toolbar buttons control the Generation Rules page.

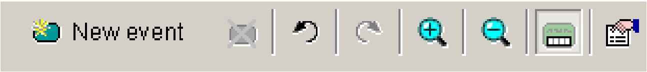


Figure 5.17: Generation Rules Toolbar.

TABLE 5.12: Recording Rules Buttons

New event	New Event. Creates a new event in the Available Events area.	🔍	Zoom Out. Makes the display appear smaller.
✖	Delete Event. Deletes the selected event.		Show/Hide Channels. Shows or hides the channel icon on the Event button.
↶	Undo. Undoes the change made to Recording Rules page. The Undo buffer has unlimited size.		Show/Hide Properties Dialog. Shows or hides the properties dialog of the selected event, action, or state.
↷	Redo. Restores changes done to the Recording Rules page.	Config is valid	This display appears when the current Recording Rules configuration can be executed by the hardware.
🔍	Zoom In. Enlarges the display (see note). There are five zoom levels. The default level is the middle one.	Config is invalid	This display appears when the current Recording Rules configuration cannot be executed by the hardware.

Note: If you have a wheel on the mouse, you can zoom by holding down the CTRL key and rolling the mouse wheel.

5.11.13 Generation Rules Page: How It Works

You can think of the Generation Rules page as a workspace for creating rules (rules that determine how the analyzer generates traces). Rules are combinations of events and actions.

An event and the action or actions associated with it form a rule state.

Briefly, creating a rule involves the following steps:

1. Creating Event buttons in the Available Events area.
2. Drag-and-drop of Event buttons to the appropriate areas (cells) in the Main Display area.
3. Assigning an action or actions to each Event button.

5.11.14 Creating Event Buttons

To create a rule, first create one or more Event buttons. As you create Event buttons, they appear in the Available Events area. You then can drag-and-drop them into the Main Display area.

To create event buttons:

1. Click the **New Event** button at the left side of the toolbar to display the New Event pop-up menu.

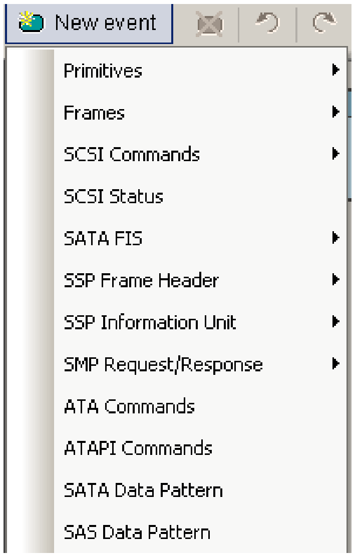

New event
Primitives
Frames
SCSI Commands
SCSI Status
SATA FIS
SSP Frame Header
SSP Information Unit
SMP Request/Response
ATA Commands
ATAPI Commands
SATA Data Pattern
SAS Data Pattern

Figure 5.18: New Event Menu.

2. Select an event, such as Primitive. The event appears in the Available Events area.

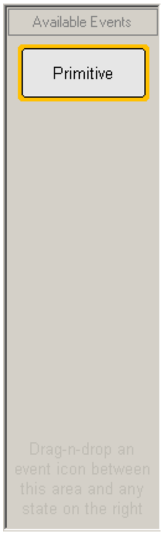

Available Events
Primitive
Drag-n-drop an event icon between this area and any state on the right

Figure 5.19: Available Events Area.

5.11.15 Dragging a Button to the Main Display Area

After you create an Event button in the Available Events area, you can drag the button to the Main Display area and drop it in the appropriate cell (a cell is a grayed-out rectangle with a dashed line around it). You can think of each cell as a target for drag-and-drop of an Event button.

To drag-and-drop the Event button:

1. Place the mouse cursor on the Event button in the Available Events area. Click the left mouse button.
2. Drag the button to the cell. When the button is in the cell, a dashed highlight line appears around the cell. Drop the button in the cell (release the left mouse button). The Event button appears in the cell.

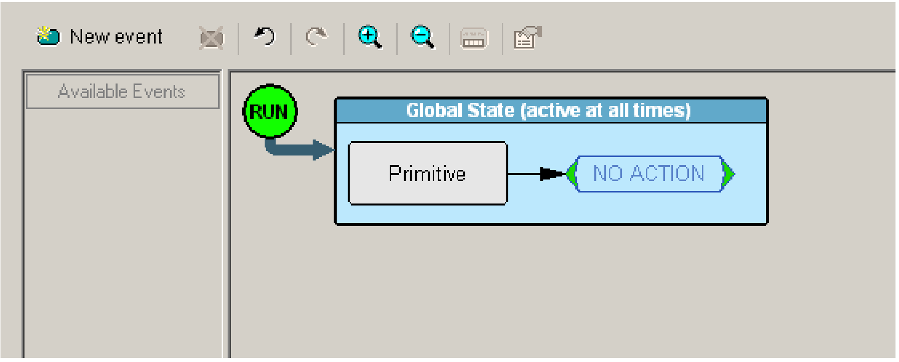

New event
Available Events
RUN
Global State (active at all times)
Primitive
NO ACTION

Figure 5.20: Event in Main Display.

The default label for the first cell is Global State, which is active at all times.

5.11.16 Assigning an Action

After you have dropped the Event button in a cell in the Main Display area, you can assign an action to the event.

Note: If you do not assign an action to an Event button, the Generator ignores the event.

To assign an action to an Event button:

1. Right-click the **Event** button to display a pop-up menu.

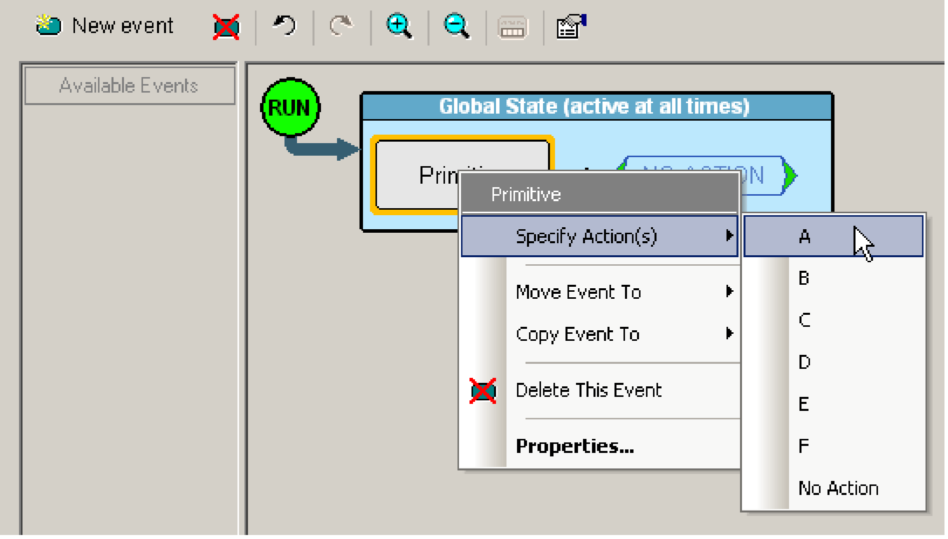

New event
Available Events
RUN
Global State (active at all times)
Prim
NO ACTION
Primitive
Specify Action(s)
Move Event To
Copy Event To
Delete This Event
Properties...
A
B
C
D
E
F
No Action

Figure 5.21: Action Menu.

2. Select **Specify Action**, and then choose an action from the submenu. The menu closes, and the action is assigned.

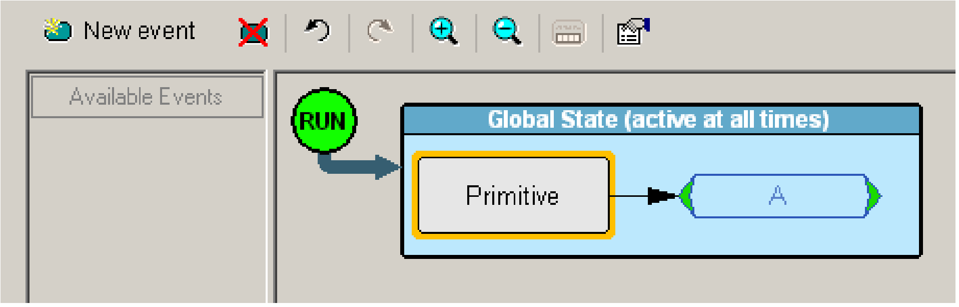

New event
Available Events
RUN
Global State (active at all times)
Primitive
A

Figure 5.22: Action in Main Display.

Note: You can also set actions within the Properties dialog for each event. Double-click the Event button to open the Properties dialog, then select the Actions tab and set your actions.

5.11.17 Generation Rules Pop-Up Menus

The Generation Rules window has context-sensitive pop-up menus that are associated with the following types of object: cells, events, and actions.

Cell Pop-up Menu

If you right-click a cell in the Main Display area that has an Event button contained in it, the Cell pop-up menu appears. The Cell pop-up menu has the following options.

- **New Event**: Displays the same menu that you get when you click the New Event button on the toolbar.
- **Properties**: Displays the Properties dialog for the selected cell.

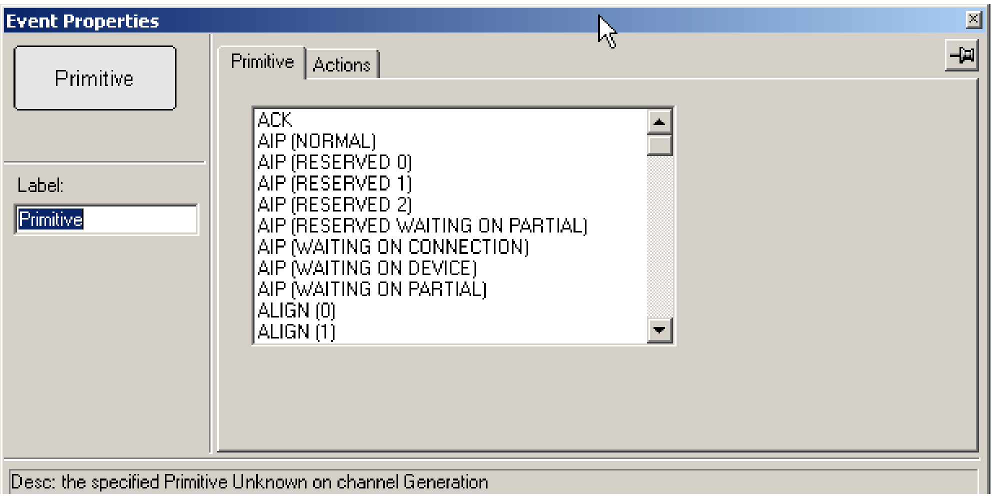
Action Pop-up Menu

If you click an Action button in the Main Display area, the Action pop-up menu appears with the options **A** through **F** and **No Action**.

Event Pop-up Menu

If you click an Event button in the Main Display area, the Event pop-up menu appears. The Event pop-up menu has the following options:

- **Specify Action(s)**: Opens the Actions submenu, allowing you to assign an action to the event. Options on this submenu are the same as those on the Action pop-up, described previously.
- **Move Event to:** Moves the selected event to a different position in the Recording Rules window.
- **Copy Event to:** Copies the selected event to a different position in the Recording Rules window.
- **Delete This Event:** Deletes the selected Event. Alternatively, you can use the Delete button on the toolbar or keyboard to delete events.
- **Properties**: Displays the Event Properties dialog for the selected event.


Event Properties
Primitive
Primitive
Actions
ACK
AIP (NORMAL)
AIP (RESERVED 0)
AIP (RESERVED 1)
AIP (RESERVED 2)
AIP (RESERVED WAITING ON PARTIAL)
AIP (WAITING ON CONNECTION)
AIP (WAITING ON DEVICE)
AIP (WAITING ON PARTIAL)
ALIGN (0)
ALIGN (1)

Label: Primitive

Desc: the specified Primitive Unknown on channel Generation

Figure 5.23: Event Properties.

The dialog lists the Properties and their Values.

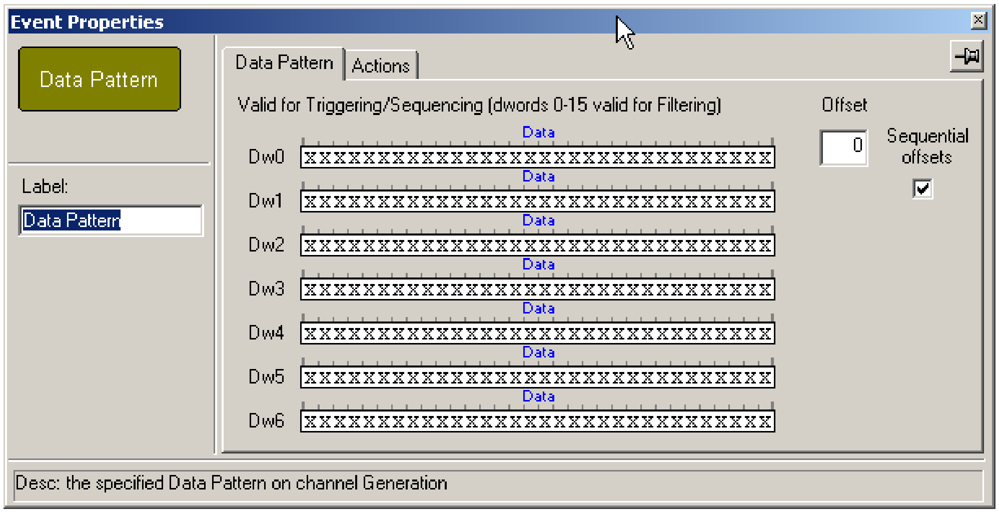
5.11.18 Events and Event Properties

Generation rules are associations between events and actions. These associations determine how trace recording occurs. The supported events are:

- **Primitives**: Primitive Categories or Primitive
- **Frames**: Open Address Frames, Identify Address Frames, Zone Broadcast Address Frames, SSP Frames, or SMP Frames
- SCSI Commands
- SCSI Status
- **SATA FIS**: Register Host to Device, Register Device to Host, Set Device Bits, DMA Activate, DMA Setup, BIST Activate, PIO Setup, Data, Route, or Vend FIS
- **SSP Frame Header**: DATA, XFER_RDY, COMMAND, RESPONSE, TASK, VENDOR, or RESERVED
- **SSP Information Unit**: Command IU, Task IU, XFER_RDY IU, or Response IU
- **SMP Request/Response**: RPT_GENERAL, RPT_MFG_INFO, DISCOVER, RPT_PHY_ERR_LOG, RPT_PHY_SATA, RPT_RT_INFO, CONFIG_RT_INFO, PHY_CONTROL, PHY_TEST_FUNCTION, CONFIG_PHY_ZONE, CONFIG_ZONE_PERM, RPT_ZONE_PERM, or RPT_ZONE_RT_TBL
- ATA Commands
- ATAPI Commands
- SATA Data Pattern
- SAS Data Pattern
- Transmitter Trainer IU Pattern

Data Pattern Mask and Match

If you select Data Pattern as the Event, you can set Data Pattern event properties in the Event Properties dialog.



Label: Data Pattern

Valid for Triggering/Sequencing (dwords 0-15 valid for Filtering)

Dw0 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Dw1 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Dw2 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Dw3 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Dw4 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Dw5 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Dw6 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Offset 0

Sequential offsets ☑

Desc: the specified Data Pattern on channel Generation

Figure 5.24: Event Properties for Data Pattern Event.

In the Data Pattern dialog, you can set the DWORD. You can set the **Offset** by entering an integer. Optionally click the **Sequential Offsets** checkbox.

5.11.19 Setting Complex “Wait For” Conditions

The Generation Options dialog lets you define complex “Wait For” events and assign a letter value (“A” through “F”) to the definition, so that you can refer to the definition by letter instead of by textual name.

After a letter value has been assigned to an event, the letter is referred to in your generation script using the following command syntax:

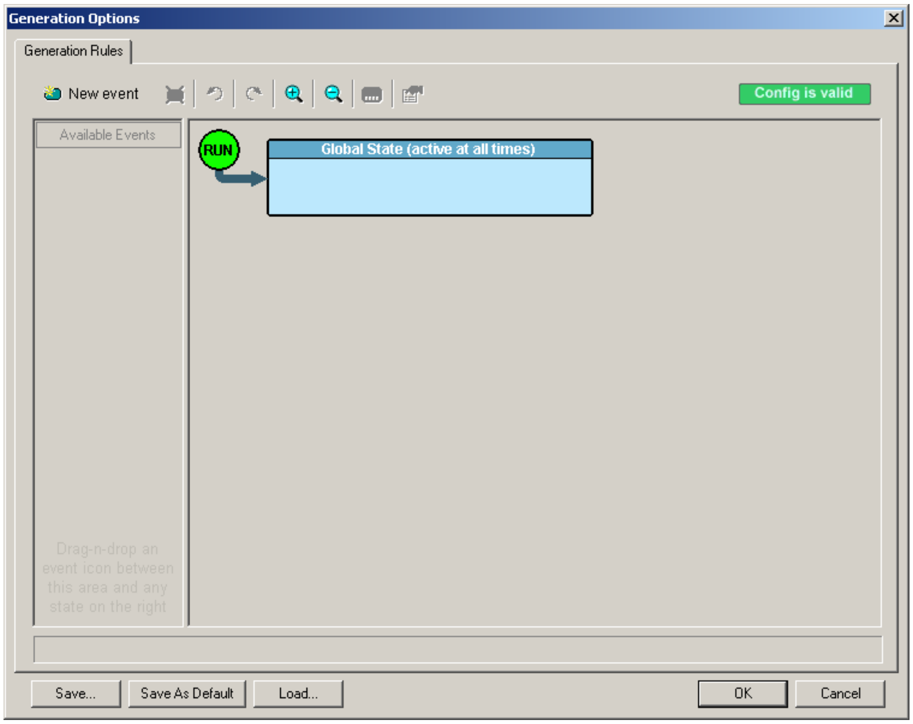
```
Wait_For {WF_REC_RESOURCES_OUTPUT_A}
```

where “A,” in this case, is the defined condition.

Setting Conditions with the Generation Options Dialog

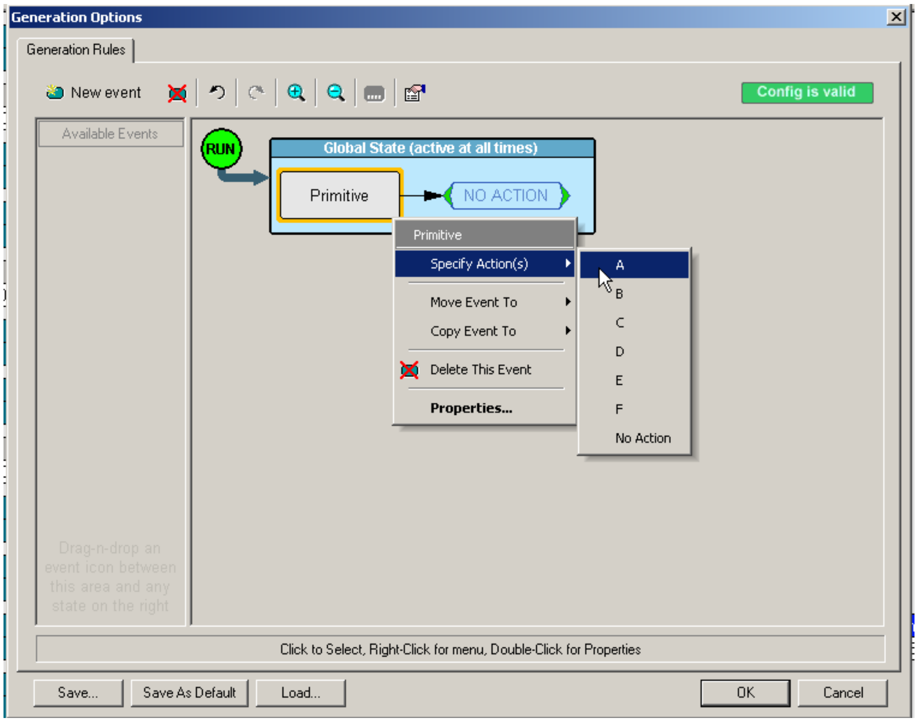
To set a complex condition, open the Generation Options dialog:

1. Select **Generate** > **Generation Options** from the menu to open the Generation Options dialog.


Generation Options
Generation Rules
New event
Config is valid
Available Events
RUN
Global State (active at all times)
Drag-n-drop an event icon between this area and any state on the right
Save...
Save As Default
Load...
OK
Cancel

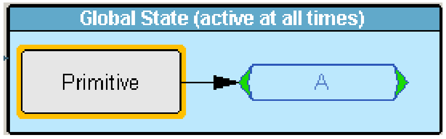
2. Click the **New Events** button and select an event from the menu. The selected event should appear in the **Available Events** area along the left side of the dialog box.
3. Drag the new event button to the **Global State** cell.

4. Right-click the new event button and select **Specify Action(s)**. A menu appears showing the letters A through F and the option "No action."


Generation Options
Generation Rules
New event
Config is valid
Available Events
RUN
Global State (active at all times)
Primitive
NO ACTION
Primitive
Specify Action(s)
Move Event To
Copy Event To
Delete This Event
Properties...
A
B
C
D
E
F
No Action
Drag-n-drop an event icon between this area and any state on the right
Save...
Save As Default
Load...
OK
Cancel

Click to Select, Right-Click for menu, Double-Click for Properties

5. Select a letter from the menu. The menu closes. The event button should now point to a neighboring button that has the letter value you assigned.


Global State (active at all times)
Primitive
A

6. After the condition has been defined, you can then add the **Wait For** command line (with whatever letter you assigned) to your script. For example:

```
Wait_For {WF_REC_RESOURCES_OUTPUT_A}
```

5.11.20 Find

Find allows searches on an open trace using one or more criteria. You can search by packet, transactions, split transaction, transfer, packet type, and fields within packets.

To run **Find**, select **Search > Find** or by click on the toolbar.

Searches can combine criteria using the options **Intersection** and **Union**.
Intersection creates AND statements such as "Find all packets with *x* and *y*."
Union creates OR statements such as "Find all packets with *x* OR *y*."

You can also perform searches in which packets or events are excluded from a trace, using the **Exclusion** option.

To perform a search:

1. Select **Find...** under **Search** on the Menu Bar.
   OR

   Click in the Toolbar.
   You see the User-Defined Find Events screen:

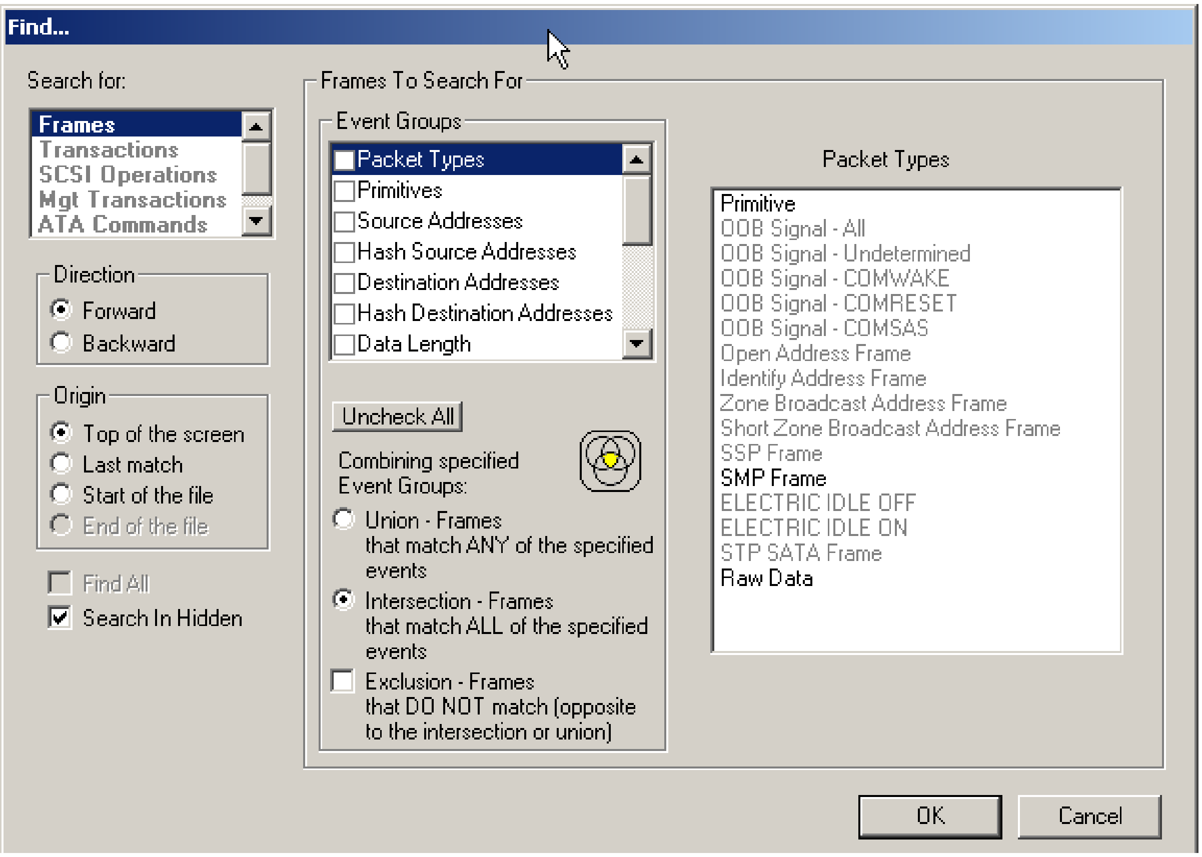
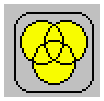

Find...
Search for:
Frames
Transactions
SCSI Operations
Mgt Transactions
ATA Commands
Direction
● Forward
○ Backward
Origin
● Top of the screen
○ Last match
○ Start of the file
○ End of the file
☐ Find All
☑ Search In Hidden
Frames To Search For
Event Groups
☐ Packet Types
☐ Primitives
☐ Source Addresses
☐ Hash Source Addresses
☐ Destination Addresses
☐ Hash Destination Addresses
☐ Data Length
Uncheck All
Combining specified Event Groups:
○ Union - Frames that match ANY of the specified events
● Intersection - Frames that match ALL of the specified events
☐ Exclusion - Frames that DO NOT match (opposite to the intersection or union)
Packet Types
Primitive
OOB Signal - All
OOB Signal - Undetermined
OOB Signal - COMWAKE
OOB Signal - COMRESET
OOB Signal - COMSAS
Open Address Frame
Identify Address Frame
Zone Broadcast Address Frame
Short Zone Broadcast Address Frame
SSP Frame
SMP Frame
ELECTRIC IDLE OFF
ELECTRIC IDLE ON
STP SATA Frame
Raw Data
OK
Cancel

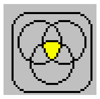
Figure 5.25: Find Dialog.

2. Select **Frames, Transactions**, **SCSI Operations**, **Management Transactions, ATA Commands**, or **OOBs** from the top left list box to list that type of event in the Events Group box.
3. Select one or more events from the **Events Group** box:
   - ❑ Packet Types (Header, PHY, Event, Transaction)
   - ❑ Primitives
   - ❑ Source Addresses
   - ❑ Hash Source Addresses
   - ❑ Destination Addresses
   - ❑ Hash Destination Addresses
   - ❑ Data Length
   - ❑ SMP Frames
   - ❑ SSP Frames
   - ❑ Errors
   - ❑ FIS Types
   - ❑ FIS Port Number

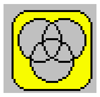
   - Channel
   - Data Pattern
   - Completion Time
4. Select one of the following options:
   - **Union:** Find all packets matching ANY of the specified events.



   - **Intersection:** Find packets matching ALL of the specified events.



   - **Exclusion:** Exclude packets matching any of the specified events.
     Exclusion works with the other two options:
     Select Union *AND* Exclusion
     (=Exclude packets with ANY of the following fields) or
     Intersection *AND* Exclusion
     (=Exclude packets with ALL of the following fields.)

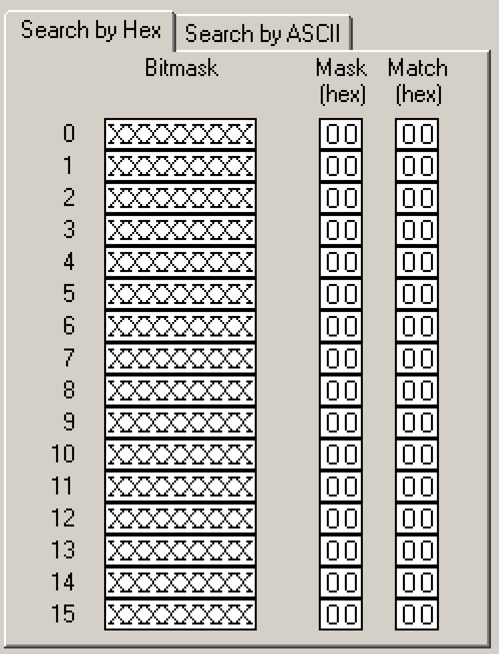


5. Optionally set the search **Direction** and **Origin**.
6. Optionally check to **Search in Hidden** or **Find All.**
7. Click **OK**.

After the search finishes, the program displays the packets meeting the search criteria.

5.11.21 Data Pattern Mask and Match

If you select Data Pattern as the Event Group in the Find dialog, you can set the Bitmask, Mask, and Match for each bit (see Figure 5.26 on page 440).



	Bitmask	Mask (hex)	Match (hex)
0	XXXXXXXX	00	00
1	XXXXXXXX	00	00
2	XXXXXXXX	00	00
3	XXXXXXXX	00	00
4	XXXXXXXX	00	00
5	XXXXXXXX	00	00
6	XXXXXXXX	00	00
7	XXXXXXXX	00	00
8	XXXXXXXX	00	00
9	XXXXXXXX	00	00
10	XXXXXXXX	00	00
11	XXXXXXXX	00	00
12	XXXXXXXX	00	00
13	XXXXXXXX	00	00
14	XXXXXXXX	00	00
15	XXXXXXXX	00	00

Figure 5.26: Data Pattern

Bitmask and Match always correlate. When you set Bitmask or Match. the other changes to maintain their correlation.

Note: If you set Bitmask/Match before setting Mask, the Mask changes to the default mask. You must change to the Mask that you want.

Note: If you set an appropriate Mask before setting Bitmask/Match, the Mask does not change automatically to a default mask if you change Bitmask/Match.

5.11.22 Find Next

To apply the previous **Find** parameters to the next search:

- Select **Find Next** under **Search** on the Menu Bar.

OR

- Click on the Toolbar.

5.11.23 Search Direction

Toggles the search forward or backwards. The current direction is indicated in the menu.

5.12 Display Options

You can select what information to display using the Display Options window.

To open the Display Options window:

- ❑ Select **Display Options** under Setup on the Menu Bar.

OR

- ❑ Click on the Toolbar.

You can select Color/Format/Hiding, Level Hiding, and Headers display options. The following sections describe these display options.

Restore Factory Presets sets all Display Options values to the installed values.

5.12.1 Color/Format/Hiding Display Options

To modify the colors, formats, and hiding options, select the **Color/Format/Hiding** tab.

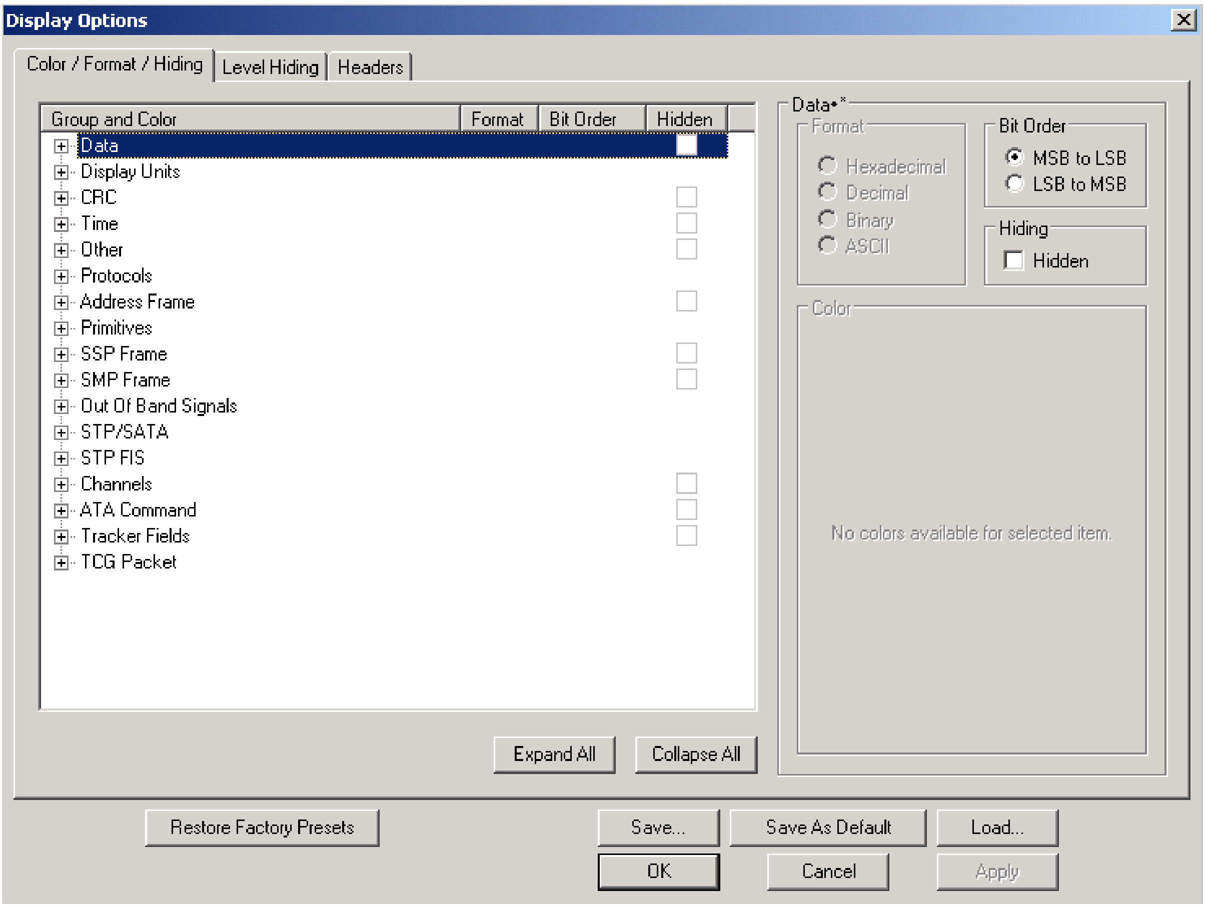

Display Options
Color / Format / Hiding
Level Hiding
Headers
Group and Color
Format
Bit Order
Hidden
Data
Display Units
CRC
Time
Other
Protocols
Address Frame
Primitives
SSP Frame
SMP Frame
Out Of Band Signals
STP/SATA
STP FIS
Channels
ATA Command
Tracker Fields
TCG Packet
Expand All
Collapse All
Data
Format
○ Hexadecimal
○ Decimal
○ Binary
○ ASCII
Bit Order
● MSB to LSB
○ LSB to MSB
Hiding
☐ Hidden
Color
No colors available for selected item.
Restore Factory Presets
Save...
Save As Default
Load...
OK
Cancel
Apply

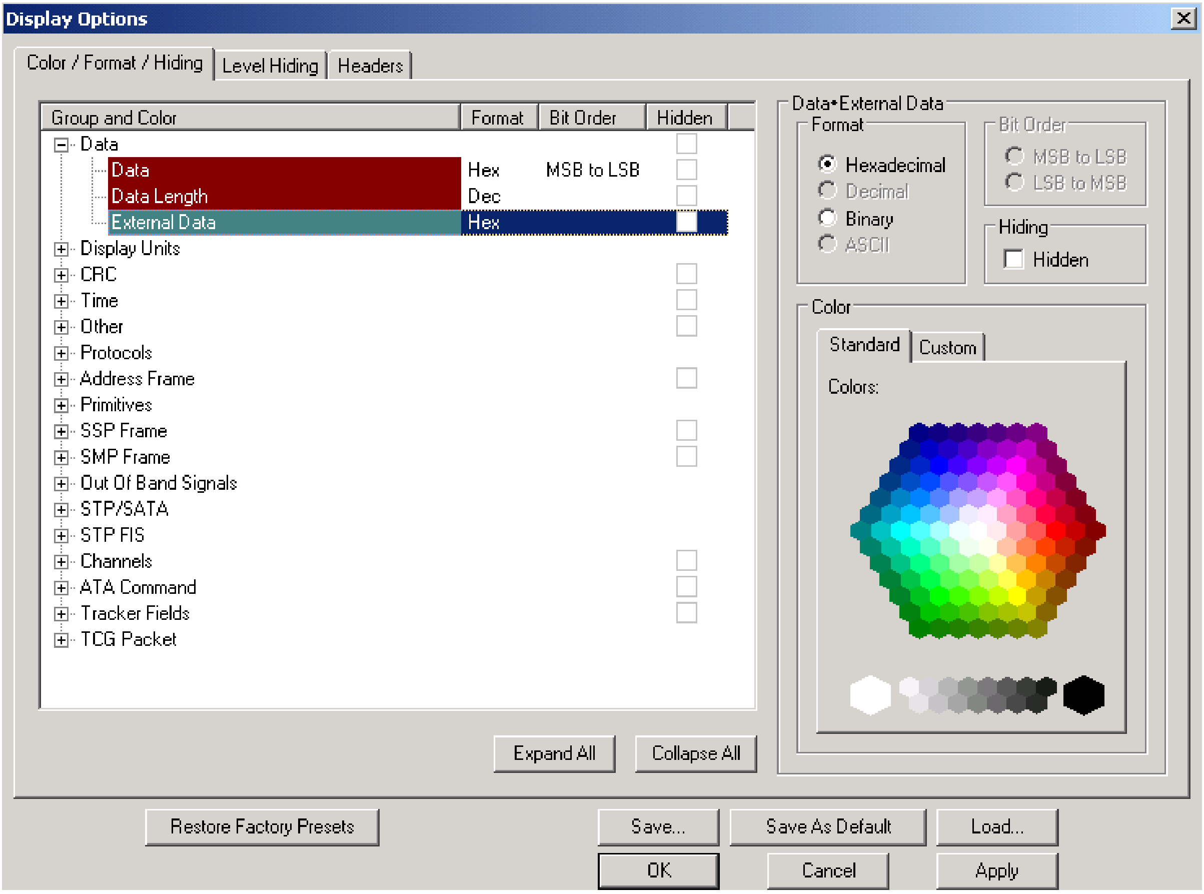
Figure 5.27: Display Options Dialog - Color, Format, Hiding Tab

Color Display Options

The program uses a default set of colors for each type of data in each group of data. The colors and color combinations are appropriate for most graphic systems. You can alter any color.

To specify a color for an information type, in the Color/Format/Hiding tab, select a row (such as Data) in the Group and Color column and expand it.

Select a data type (such as Data Length) in the Group, then select a color in the Color section, using Standard or Custom colors. Use a bright color for each important field.


Display Options
Color / Format / Hiding
Level Hiding
Headers
Group and Color
Format
Bit Order
Hidden
Data
Display Units
CRC
Time
Other
Protocols
Address Frame
Primitives
SSP Frame
SMP Frame
Out Of Band Signals
STP/SATA
STP FIS
Channels
ATA Command
Tracker Fields
TCG Packet
Expand All
Collapse All
Data•External Data
Format
Bit Order
MSB to LSB
LSB to MSB
Hiding
Color
Standard
Custom
Colors:
Restore Factory Presets
Save...
Save As Default
Load...
OK
Cancel
Apply

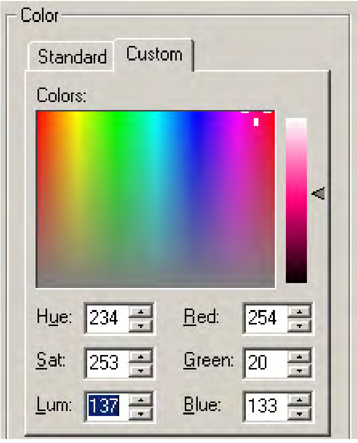
Group and Color	Format	Bit Order	Hidden
Data	Hex	MSB to LSB	☐
Data Length	Dec		☐
External Data	Hex		☐

Format: ● Hexadecimal ○ Decimal ○ Binary ○ ASCII

Hiding: ☐ Hidden

Figure 5.28: Display Options Dialog - Color

To customize colors, use the Custom tab.


Color
Standard
Custom
Colors:

Hue: 234 Red: 254

Sat: 253 Green: 20

Lum: 137 Blue: 133

Figure 5.29: Custom Colors

Note: You cannot change the color of an Invalid Data (packet error) field. It is permanently set to red.

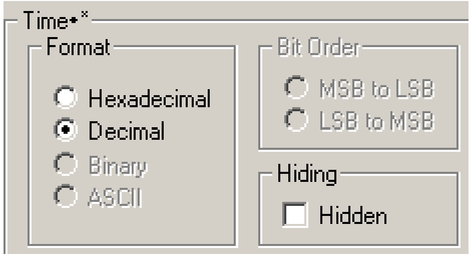
Formats Display Options

For each type of data in each group of data, the program has a default data format. Examples of number data formats are Binary, Decimal, and Hexadecimal. An example of a text data format is ASCII.

To specify a data format for an information type, in the Color/Format/Hiding tab, select a row (such as Data) in the Group and Color column and expand it.

Select a data type in the Group.

Select a format in the Format section. The following formats are available:



Time•*

Format

○ Hexadecimal
● Decimal
○ Binary
○ ASCII

Bit Order

○ MSB to LSB
○ LSB to MSB

Hiding

☐ Hidden

Figure 5.30: Formats.

If available, select **Bit Order** in the Format section. The options are MSB to LSB or LSB to MSB.

Hiding Display Options

By default, no data is hidden. You can hide any group of data and any type of data.

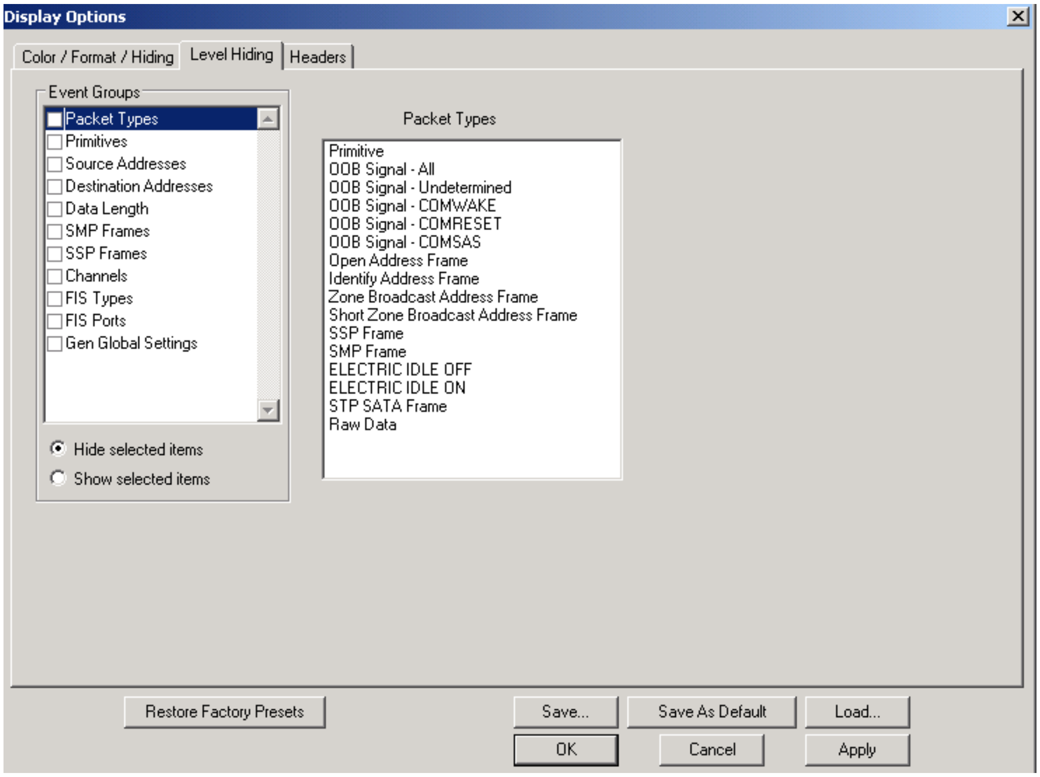
To hide one or more fields, select the Group and Data type in the Group and Color column, then click the **Hidden** checkbox in the display or the **Hidden** checkbox in the Hiding section of the Format section.

Level Hiding Options

By default, nothing is hidden. You can hide:

- Packet Types
- Primitives
- Source Addresses
- Destination Addresses
- Data Length
- SMP Frames
- SSP Frames
- Channels
- FIS Types
- FIS Ports
- Gen Global Settings

Select the **Level Hiding** tab, then select the data types to hide.


Display Options
Color / Format / Hiding
Level Hiding
Headers
Event Groups
Packet Types
Restore Factory Presets
Save...
Save As Default
Load...
OK
Cancel
Apply

Event Groups:

- ☐ Packet Types
- ☐ Primitives
- ☐ Source Addresses
- ☐ Destination Addresses
- ☐ Data Length
- ☐ SMP Frames
- ☐ SSP Frames
- ☐ Channels
- ☐ FIS Types
- ☐ FIS Ports
- ☐ Gen Global Settings

● Hide selected items
○ Show selected items

Packet Types:

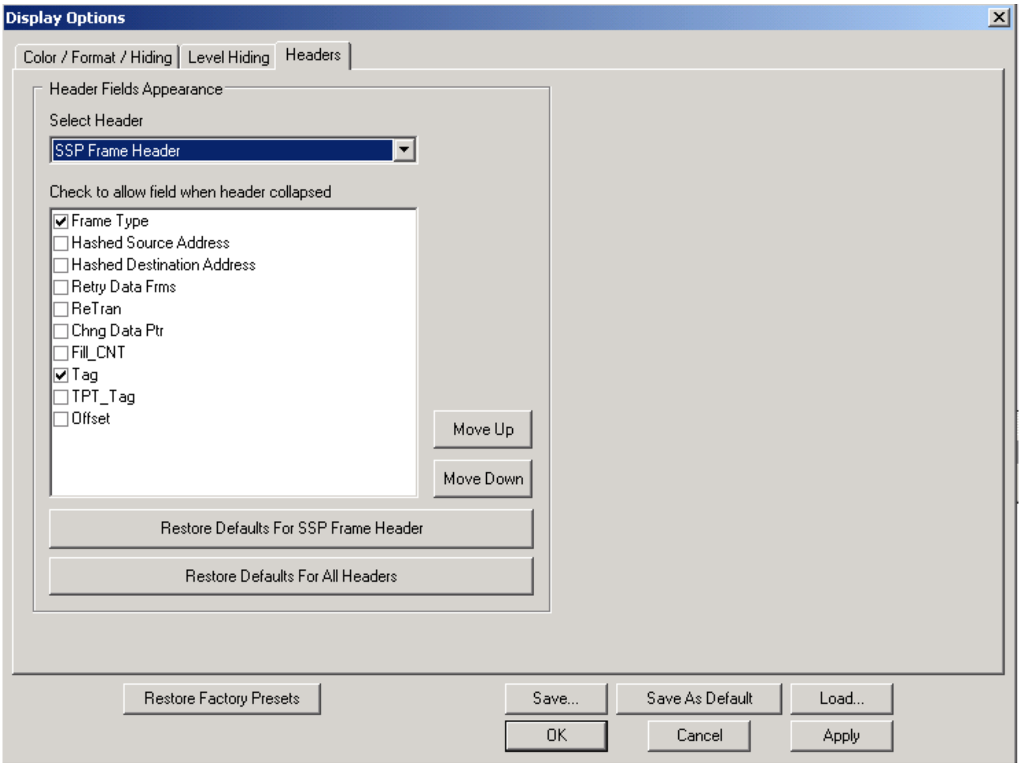
- Primitive
- OOB Signal - All
- OOB Signal - Undetermined
- OOB Signal - COMWAKE
- OOB Signal - COMRESET
- OOB Signal - COMSAS
- Open Address Frame
- Identify Address Frame
- Zone Broadcast Address Frame
- Short Zone Broadcast Address Frame
- SSP Frame
- SMP Frame
- ELECTRIC IDLE OFF
- ELECTRIC IDLE ON
- STP SATA Frame
- Raw Data

Figure 5.31: Level Hiding Tab.

You can select to **Hide selected items** or **Show selected items**.

Headers Options

You can choose the appearance of header fields. Select the **Header** tab, then select the header (see Figure 5.32 on page 445).


Display Options
Color / Format / Hiding
Level Hiding
Headers
Header Fields Appearance
Move Up
Move Down
Restore Defaults For SSP Frame Header
Restore Defaults For All Headers
Restore Factory Presets
Save...
Save As Default
Load...
OK
Cancel
Apply

Select Header: SSP Frame Header

Check to allow field when header collapsed

☑ Frame Type
☐ Hashed Source Address
☐ Hashed Destination Address
☐ Retry Data Frms
☐ ReTran
☐ Chng Data Ptr
☐ Fill_CNT
☑ Tag
☐ TPT_Tag
☐ Offset

Figure 5.32: Level Hiding Tab

Available headers are:

- SSP Frame Header
- SMP Report General (Request or Response)
- SMP Report Mfg Info (Request or Response)
- SMP Discover (Request or Response)
- SMP Report Phy Error Log (Request or Response)
- SMP Report Route Info (Request or Response)
- SMP Configure Route Info (Request or Response)
- SMP Phy Control (Request or Response)
- SMP Phy Test Function (Request or Response)
- SMP Configure Phy Zone (Request or Response)
- SMP Configure Zone Permission (Request or Response)
- SMP Report Zone Permission (Request or Response)
- SMP Report Zone Routing Table (Request or Response)
- STP Register Host to Device FIS
- STP Register Device to Host FIS
- STP Register Device Bits Device to Host FIS
- STP DMA Activate Device to Host FIS
- STP DMA Setup FIS
- STP BIST Activate FIS
- STP PIO Setup Device to Host FIS
- STP Data FIS
- STP Frame Summary Header

- SATA Frame Summary Header
- SAS Delta Time

Check boxes to allow a field when the selected header is collapsed. Example header fields are:

- Frame Type
- Function
- Result
- Offset
- FIS Type

You can move items up and down.

You can select to **Restore Defaults** for the selected header or all headers.

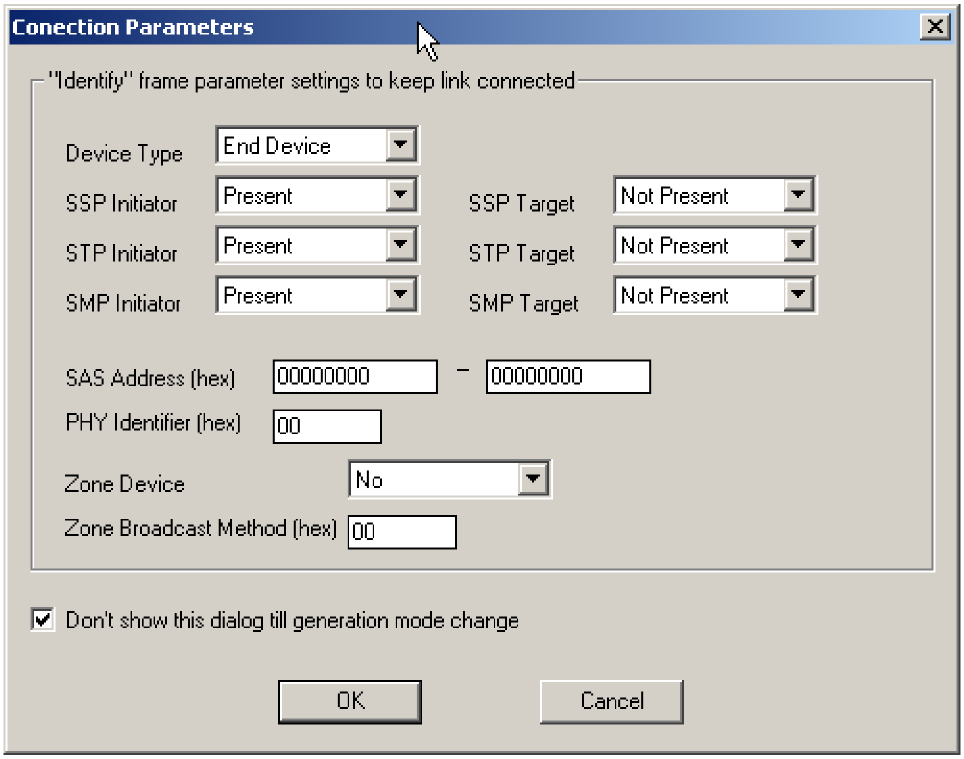
Saving Display Options

You can save a set of Display Options values, make a set the default settings, or use a saved set of values with the commands at the bottom of the **Display Options** window:

- To save the current Display Options values in an options file for use in future sessions, click **Save**. Enter a file name without a file name extension. The program adds the **.opt** extension. (The file must have an **.opt** file name extension.)
- To load a previously saved **.opt** file, click **Load** and select a file name.
- To save the current Display Options values in the **default.opt** options file for use as the default display options, click **Save as Default**. (Do not delete the **default.opt** file.)
- To apply the current Display Options values, click **Apply**. The Display Options window remains open.
- To apply the current Display Options values and close the Display Options window, click **OK**.
- To cancel unsaved changes to display values and exit the Display Options window, click **Cancel**.

5.12.2 Connection Parameters

To display the connection parameters (see Figure 5.33 on page 447), select **Generate > Connect Parameters**.



Conection Parameters

"Identify" frame parameter settings to keep link connected

Device Type: End Device

SSP Initiator: Present

SSP Target: Not Present

STP Initiator: Present

STP Target: Not Present

SMP Initiator: Present

SMP Target: Not Present

SAS Address (hex): 00000000 - 00000000

PHY Identifier (hex): 00

Zone Device: No

Zone Broadcast Method (hex): 00

☑ Don't show this dialog till generation mode change

Figure 5.33: Connection Parameters Dialog

You can set the "Identify" frame parameter settings to keep the link connected:

- **Device Type**: End Device, Edge Expander, or Fanout Expander
- **SSP Initiator**: Present or Not Present
- **STP Initiator**: Present or Not Present
- **SMP Initiator**: Present or Not Present
- **SSP Target**: Present or Not Present
- **STP Target**: Present or Not Present
- **SMP Target**: Present or Not Present
- **SAS Address (hex)**: eight digits - eight digits
- **PHY Identifier (hex)**: two digits
- **Zone Device**: Yes or No
- Zone Broadcast Method (hex): two digits

You can select to not show the dialog until there is a generation mode change.

5.12.3 Resetting the Toolbar

The Analyzer Toolbar has the following:

- **Launch Jammer**: Switches to InFusion frame.
- **Launch Analyzer** : Switches to Analyzer frame.
- **Start Recording**: Start Analyzer without switching to Analyzer frame.
- **Stop Recording**: Stop Analyzer without switching to Analyzer frame.
- **Abort Recording**: Abort Analyzer without switching to Analyzer frame.

The Generator Toolbar has the following:

- **Start Generation**
- **Stop Generation**
- **Resume Generation**
- **Connect Link**
- **Disconnect Link**
- **Generation Options**

From time to time (such as following a software upgrade), it is possible for the buttons on the toolbar to not match their intended function. You can reset the toolbar by performing the following steps:

1. Select **View > Toolbars** from the menu bar.
2. Select **Customize** from the submenu to display the Customize dialog box.

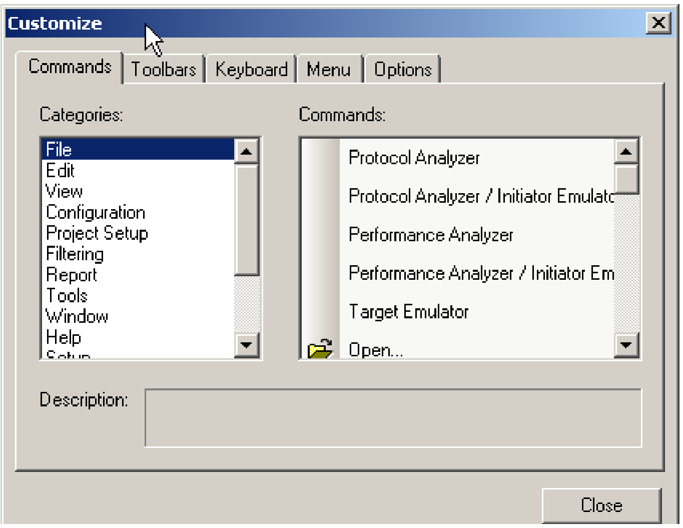

Customize
Commands
Toolbars
Keyboard
Menu
Options
Categories:
File
Edit
View
Configuration
Project Setup
Filtering
Report
Tools
Window
Help
Commands:
Protocol Analyzer
Protocol Analyzer / Initiator Emulatc
Performance Analyzer
Performance Analyzer / Initiator Em
Target Emulator
Open...
Description:
Close

Figure 5.34: Customize Commands.

3. Select the **Toolbars** tab to display the Toolbars page of the Customize dialog box.

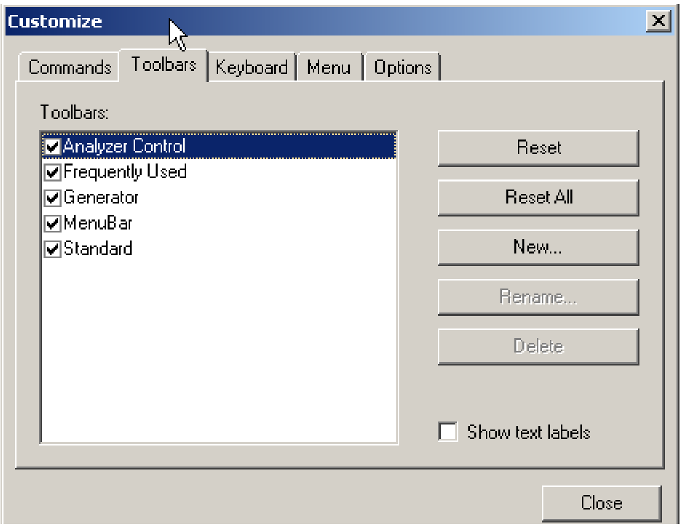

Customize
Commands
Toolbars
Keyboard
Menu
Options
Toolbars:
☑ Analyzer Control
☑ Frequently Used
☑ Generator
☑ MenuBar
☑ Standard
Reset
Reset All
New...
Rename...
Delete
☐ Show text labels
Close

Figure 5.35: Customize Toolbars.

4. Click the **Reset All** button.
   - ❑ The toolbar resets to the factory defaults.

5.13 Differences Between Sierra M12x Trainers and Sierra M6-x Trainers

5.13.1 Auto-Align Feature

Auto-align feature is changed according to the specification in 12 Gbps designs:

According to the new specification:

- ❑ 1 Align primitive should be inserted with in every 128 DWORDS when the link speed is 1.5 Gbps
- ❑ 2 Align Primitives should be inserted with in every 256 DWORDS when the link speed is 3 Gbps
- ❑ 4 Align Primitives should be inserted with in every 512 DWORDS when the link speed is 6 Gbps
- ❑ 8 Align Primitives should be inserted with in every 512 DWORDS when link speed is 12 Gbps

Due to implementation constraints 2 Align primitives are inserted in every 128 DWORDS when the Link speed is 1.5 Gbps and 2 Align primitives are inserted in every 256 DWORDS for other Link speeds.

In 6 Gbps designs one align primitive is inserted in every 2048 DWORDS.

5.13.2 12 Gbps Speed Negotiation is Added

- ❑ 12 Gbps Speed negotiation (Tx training window and Rx training window) is added

Due to differences in Serdes blocks and Trainer Receiver Clock differences between 12 Gbps and 6 Gbps designs, the Rx path of 12 Gbps designs may have a different reception delay compared to 6 Gbps designs. This may affect Wait for Statements (time taken to exit wait statements may be different).

5.13.3 Rx Path of 12 Gbs Designs

- ❑ Rx path of 12 Gbps designs may have different delay compared to 6 Gbs designs

5.13.4 HOLD / HOLDA Response Time

Due to Serdes Difference Hold / HoldA response time is different in 12 Gbps designs compared to 6 Gbps. The table below shows the Hold / HoldA Response times in Number of Dwords.

TABLE 5.13: Hold / HoldA Response Times

Speed	Sierra M12x	Sierra M6-x
1.5 Gbps	10 Dwords	14 Dwords
3 Gbps	20 Dwords	21 Dwords
6 Gbps	28 Dwords	35 Dwords

Note: All the above values are approximate values. There may be few Dwords difference from one run to other.

5.13.5 Manual Tx Rx Setting Configuration

In 12 Gbps designs, the User is given provision to change Tx and Rx Serdes parameters.

5.13.6 Extra Commands Added for 12 Gbps Designs

To support Manual 12 Gbps connect, several commands are added to the design:

- ❑ Last Received TTIU (LRT)
- ❑ Local_Tx_status_word
- ❑ Training_ERROR_COUNT

5.13.7 Added Support for Gen4 Designs

For Gen4 designs with SSC and Gen4 designs without SSC, PHY capability bits have been added in 12 Gbps designs.

Support for 12 Gbps speed is added in PHY capability Window.

5.13.8 Added Optical Mode Support

Active Optical Cable (AOC) support added in 12 Gbps designs.

5.13.9 Two Dword Processing in 12 Gbps Designs

Extra Idles may be inserted between two transmitted DWORDS (changes from case to case) to handle Two Dword processing in 12 Gbps designs.

After loading of control, OOB, speed negotiation and time out registers, 2 idles are inserted in 6 Gbps designs and 4 idles are inserted in 12 Gbps designs.

During Branch Block (like Loop, Jump, Conditional Jump) execution a few (about 6-8) extra Idles are added in 12 Gbps designs. (Depending on the script, the extra idle count changes.)

Appendix A

Creating a Pattern Generator File

You may use any text editor or word processor to create a pattern generator file (*.spg) using the following conventions:

Note: If you have purchased a license you can enable the pattern generator (see "Port Configuration" on page 108.)

6.1 Key words

ALIGN, CONT, DMAT, EOF, HOLD, HOLDA, PMACK, PMNAK, PMREQ_P, PMREQ_S, R_ERR, R_IP, R_OK, R_RDY, SOF, SYNC, WTRM, X_RDY, XXXX, LOOP, Enable, Disable, Host, Device, Scramble, Role, END_OF_FILE.

6.2 Comment format

```
/*Comment text*/
```

6.3 Primitive definition format

To add an ALIGN primitive, use ALIGN or 27.3 10.2 10.2 K28.5

To add a CONT primitive, use CONT or 25.4 25.4 10.5 K28.3

6.4 Loop definition format

You may write a defined pattern into memory repeatedly by enabling a loop.

Loop definition allows either "Enable" or Disable". To enable looping use: Loop=Enable

6.5 Scramble definition format

Scramble definition allows either "Enable" or Disable". To enable scramble use: Scramble=Enable

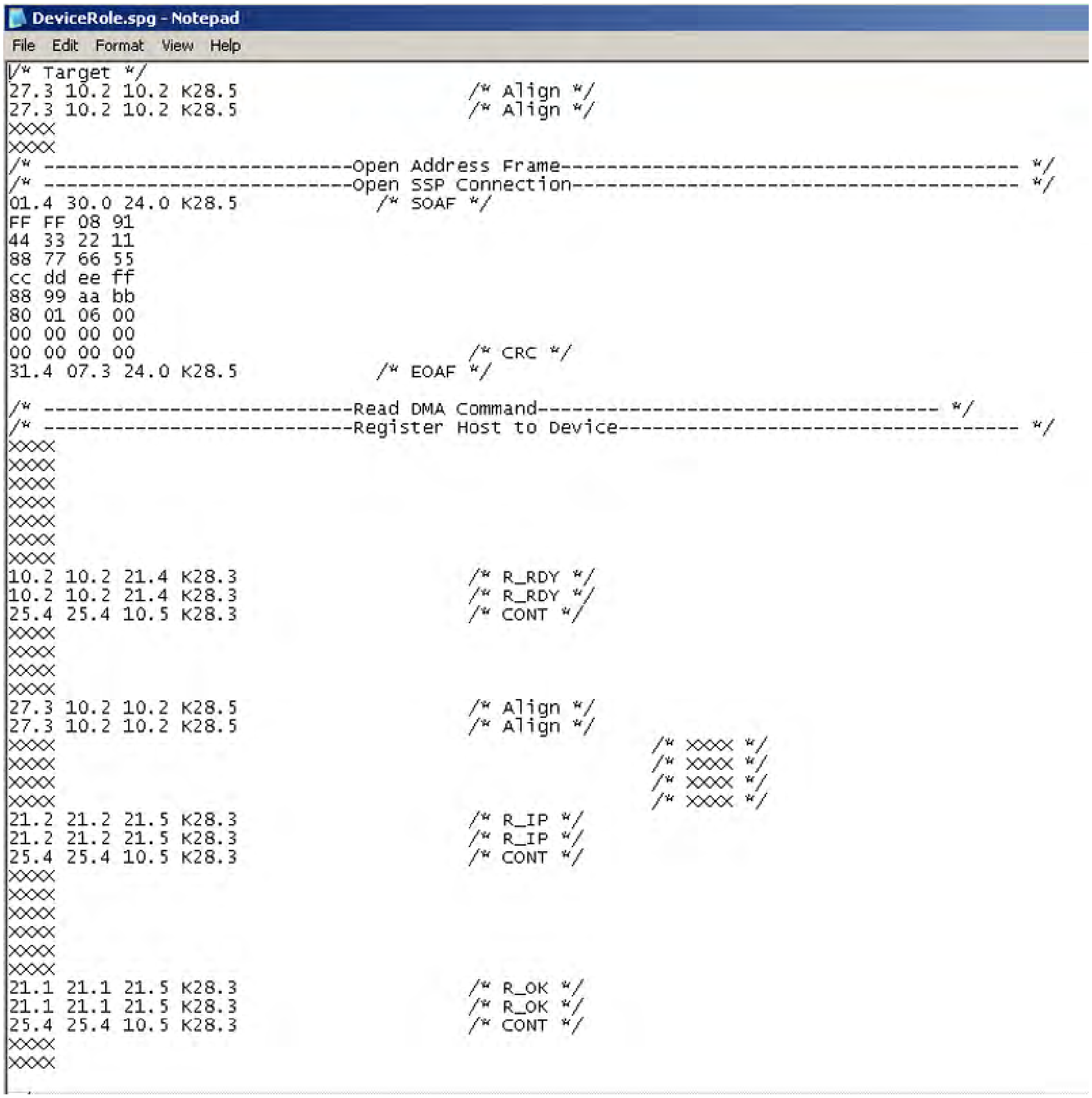
6.6 Role definition format

To specify SATA hardware role: Role=Host or Role=Device

6.7 END_OF_FILE definition

A pattern generator file must include END_OF_FILE as the last statement in the file.

Figure A-1 illustrates a typical Pattern Generator file.



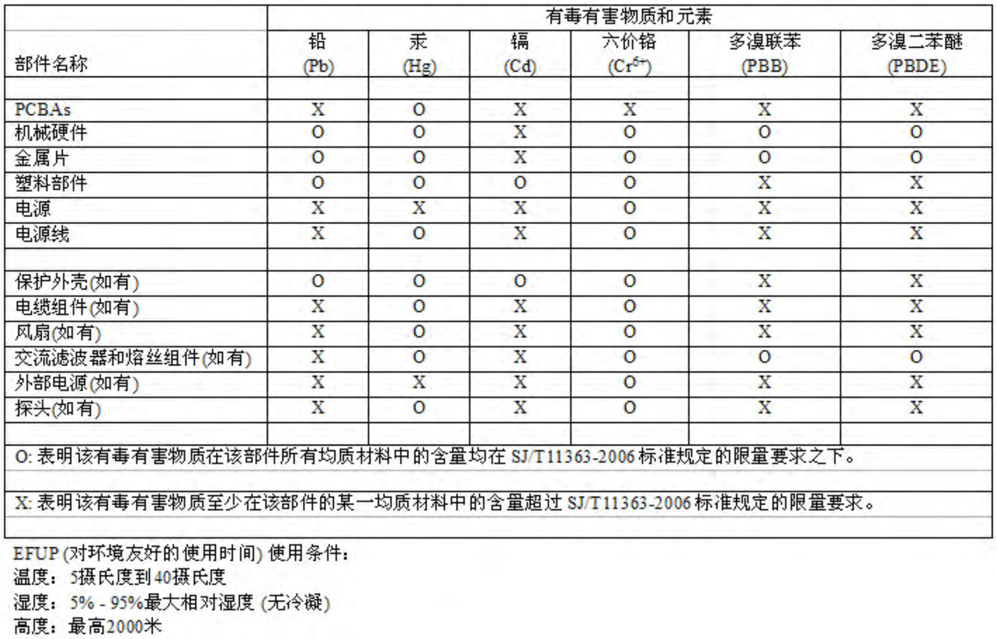
```
/* Target */
27.3 10.2 10.2 K28.5                    /* Align */
27.3 10.2 10.2 K28.5                    /* Align */
XXXX
XXXX
/* ---------------------------Open Address Frame---------------------------------------- */
/* ---------------------------Open SSP Connection--------------------------------------- */
01.4 30.0 24.0 K28.5            /* SOAF */
FF FF 08 91
44 33 22 11
88 77 66 55
cc dd ee ff
88 99 aa bb
80 01 06 00
00 00 00 00
00 00 00 00                             /* CRC */
31.4 07.3 24.0 K28.5            /* EOAF */

/* ---------------------------Read DMA Command----------------------------------- */
/* ---------------------------Register Host to Device----------------------------------- */
XXXX
XXXX
XXXX
XXXX
XXXX
XXXX
XXXX
10.2 10.2 21.4 K28.3                    /* R_RDY */
10.2 10.2 21.4 K28.3                    /* R_RDY */
25.4 25.4 10.5 K28.3                    /* CONT */
XXXX
XXXX
XXXX
XXXX
27.3 10.2 10.2 K28.5                    /* Align */
27.3 10.2 10.2 K28.5                    /* Align */
XXXX                                                    /* XXXX */
XXXX                                                    /* XXXX */
XXXX                                                    /* XXXX */
XXXX                                                    /* XXXX */
21.2 21.2 21.5 K28.3                    /* R_IP */
21.2 21.2 21.5 K28.3                    /* R_IP */
25.4 25.4 10.5 K28.3                    /* CONT */
XXXX
XXXX
XXXX
XXXX
XXXX
XXXX
21.1 21.1 21.5 K28.3                    /* R_OK */
21.1 21.1 21.5 K28.3                    /* R_OK */
25.4 25.4 10.5 K28.3                    /* CONT */
XXXX
XXXX
```

Figure A.1: Sample Pattern Generator File *spg

Appendix B

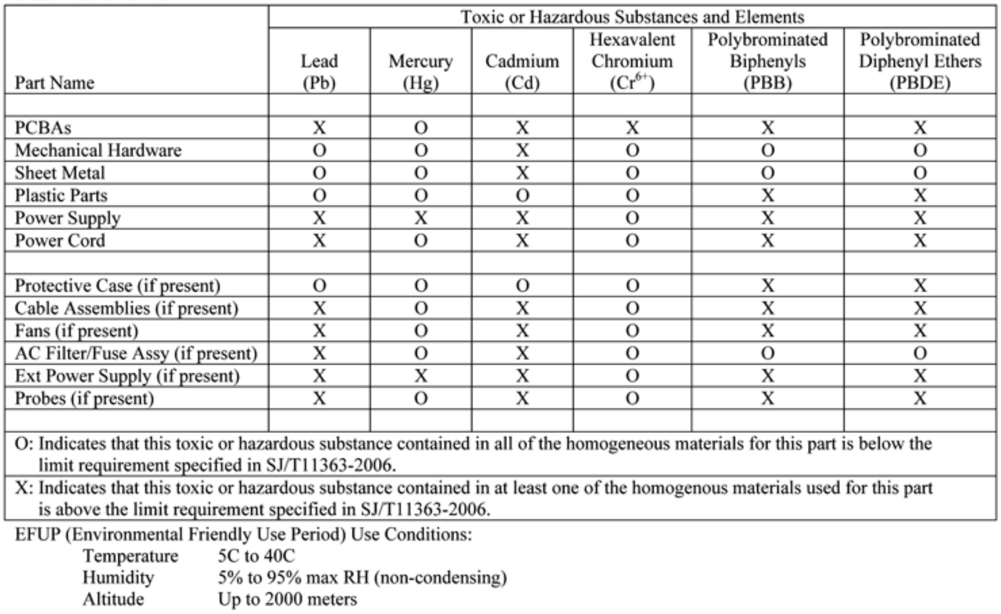
China Restriction of Hazardous Substances Table

The following tables are supplied in compliance with China's Restriction of Hazardous Substances (China RoHS) requirements:



部件名称	有毒有害物质和元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr^{6+})	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
PCBAs	X	O	X	X	X	X
机械硬件	O	O	X	O	O	O
金属片	O	O	X	O	O	O
塑料部件	O	O	O	O	X	X
电源	X	X	X	O	X	X
电源线	X	O	X	O	X	X
保护外壳(如有)	O	O	O	O	X	X
电缆组件(如有)	X	O	X	O	X	X
风扇(如有)	X	O	X	O	X	X
交流滤波器和熔丝组件(如有)	X	O	X	O	O	O
外部电源(如有)	X	X	X	O	X	X
探头(如有)	X	O	X	O	X	X
O: 表明该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求之下。						
X: 表明该有毒有害物质至少在该部件的某一均质材料中的含量超过 SJ/T11363-2006 标准规定的限量要求。						

EFUP (对环境友好的使用时间) 使用条件:
温度: 5摄氏度到40摄氏度
湿度: 5% - 95%最大相对湿度 (无冷凝)
高度: 最高2000米



Part Name	Toxic or Hazardous Substances and Elements					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr^{6+})	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
PCBAs	X	O	X	X	X	X
Mechanical Hardware	O	O	X	O	O	O
Sheet Metal	O	O	X	O	O	O
Plastic Parts	O	O	O	O	X	X
Power Supply	X	X	X	O	X	X
Power Cord	X	O	X	O	X	X
Protective Case (if present)	O	O	O	O	X	X
Cable Assemblies (if present)	X	O	X	O	X	X
Fans (if present)	X	O	X	O	X	X
AC Filter/Fuse Assy (if present)	X	O	X	O	O	O
Ext Power Supply (if present)	X	X	X	O	X	X
Probes (if present)	X	O	X	O	X	X
O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement specified in SJ/T11363-2006.						
X: Indicates that this toxic or hazardous substance contained in at least one of the homogenous materials used for this part is above the limit requirement specified in SJ/T11363-2006.						

EFUP (Environmental Friendly Use Period) Use Conditions:

Temperature	5C to 40C
Humidity	5% to 95% max RH (non-condensing)
Altitude	Up to 2000 meters

7.1 WAN Operation

WAN connected operation is supported. Contact factory for details of operation. Refer "How to Contact Teledyne LeCroy" on page 455 for contact information.

Appendix C

How to Contact Teledyne LeCroy

Type of Service	Contact
Call for technical support	US and Canada: 1 (800) 909-7112 Worldwide: 1 (408) 653-1260
Fax your questions	Worldwide: 1 (408) 727-6622
Write a letter	Teledyne LeCroy Protocol Solutions Group Customer Support 3385 Scott Blvd. Santa Clara, CA 95054-3115 USA
Send e-mail	psgsupport@teledynelecroy.com
Visit Teledyne LeCroy's web site	teledynelecroy.com/
Tell Teledyne LeCroy	Report a problem to Teledyne LeCroy Support via e-mail by selecting **Help>Tell Teledyne LeCroy** from the application toolbar. This requires that an e-mail client be installed and configured on the host machine.

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